

## PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

MILHENCH, Howard, L.  
R.G.C. Jenkins & Co.  
26 Caxton Street  
London SW1H 0RJ  
ROYAUME-UNI

|  |  |
|--|--|
| Date of mailing (day/month/year)<br>12 March 2001 (12.03.01) | <b>IMPORTANT NOTIFICATION</b>  |
| Applicant's or agent's file reference                        |  |
| International application No.<br>PCT/GB00/01204              | International filing date (day/month/year)<br>29 March 2000 (29.03.00) |

|   |  |
|---|--|
| 1. The following indications appeared on record concerning:   |  |
| <input type="checkbox"/> the applicant  | <input type="checkbox"/> the inventor <input checked="" type="checkbox"/> the agent <input type="checkbox"/> the common representative |
| Name and Address<br>MURGITROYD & COMPANY<br>373 Scotland Street<br>Glasgow G5 8QA<br>United Kingdom   | State of Nationality   |
|   | State of Residence   |
|   | Telephone No.<br>0141 307 8400   |
|   | Facsimile No.<br>0141 307 8401   |
| 2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:   |  |
| <input checked="" type="checkbox"/> the person <input checked="" type="checkbox"/> the name <input checked="" type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence |  |
| Name and Address<br>MILHENCH, Howard, L.<br>R.G.C. Jenkins & Co.<br>26 Caxton Street<br>London SW1H 0RJ<br>United Kingdom   | State of Nationality   |
|   | State of Residence   |
|   | Telephone No.<br>+44 (0)20 7931 7141   |
|   | Facsimile No.<br>+44 (0)20 7222 4660   |
| 3. Further observations, if necessary:  |  |
| 4. A copy of this notification has been sent to:  |  |
| <input checked="" type="checkbox"/> the receiving Office  | <input type="checkbox"/> the designated Offices concerned  |
| <input type="checkbox"/> the International Searching Authority  | <input checked="" type="checkbox"/> the elected Offices concerned  |
| <input checked="" type="checkbox"/> the International Preliminary Examining Authority   | <input type="checkbox"/> other:  |

|   |  |
|---|--|
| The International Bureau of WIPO<br>34, chemin des Colombettes<br>1211 Geneva 20, Switzerland | Authorized officer<br>Dominique DELMAS |
| Facsimile No.: (41-22) 740.14.35  | Telephone No.: (41-22) 338.83.38       |

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## PATENT COOPERATION TREATY

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NOTIFICATION OF THE RECORDING  
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| Applicant's or agent's file reference                        |  |
| International application No.<br>PCT/GB00/01204              | International filing date (day/month/year)<br>29 March 2000 (29.03.00) |

1. The following indications appeared on record concerning:

☒ the applicant
 ☐ the inventor
 ☐ the agent
 ☐ the common representative

|   |                            |                          |
|---|----------------------------|--------------------------|
| Name and Address<br>BUCHANAN, Nigel<br>Beechtree Cottage<br>New Gilston<br>Fife KY8 5TF<br>United Kingdom | State of Nationality<br>GB | State of Residence<br>GB |
|   | Telephone No.              |                          |
|   | Facsimile No.              |                          |
|   | Teleprinter No.            |                          |

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☒ the person
 ☒ the name
 ☒ the address
 ☐ the nationality
 ☐ the residence

|  |                            |                          |
|--|----------------------------|--------------------------|
| Name and Address<br>SMART TOOLS LIMITED<br>Beech Tree Cottage<br>New Gilston, By Leven<br>Fyfe KY8 5TF<br>United Kingdom | State of Nationality<br>GB | State of Residence<br>GB |
|  | Telephone No.              |                          |
|  | Facsimile No.              |                          |
|  | Teleprinter No.            |                          |

3. Further observations, if necessary:

**The applicant identified in Box No.1 is to be considered as applicant/inventor for the purposes of US only, since he assigned his rights for all designated States except US to a new applicant as indicated below.**

4. A copy of this notification has been sent to:

|   |   |
|---|---|
| <input checked="" type="checkbox"/> the receiving Office                              | <input type="checkbox"/> the designated Offices concerned         |
| <input type="checkbox"/> the International Searching Authority                        | <input checked="" type="checkbox"/> the elected Offices concerned |
| <input checked="" type="checkbox"/> the International Preliminary Examining Authority | <input type="checkbox"/> other:                                   |

|   |  |
|---|--|
| The International Bureau of WIPO<br>34, chemin des Colombettes<br>1211 Geneva 20, Switzerland<br><br>Facsimile No.: (41-22) 740.14.35 | Authorized officer<br><br>Dominique DELMAS<br><br>Telephone No.: (41-22) 338.83.38 |
|---|--|

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# PATENT COOPERATION TREATY

## PCT

### NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

MILHENCH, Howard, L.  
R.G.C. Jenkins & Co.  
26 Caxton Street  
London SW1H 0RJ  
ROYAUME-UNI

R. G. C. JENKINS & CO.

★ 18 MAR 2001 ★

CHARTERED PATENT AGENTS

|   |   |
|---|---|
| <b>Date of mailing (day/month/year)</b><br>12 March 2001 (12.03.01) | <b>Applicant's or agent's file reference</b><br>J43114wo                      |
| <b>International application No.</b><br>PCT/GB00/01204              | <b>International filing date (day/month/year)</b><br>29 March 2000 (29.03.00) |

#### IMPORTANT NOTIFICATION

|  |   |   |   |                      |  |                      |  |                        |  |
|--|---|---|---|----------------------|--|----------------------|--|------------------------|--|
| 1. The following indications appeared on record concerning:<br><input checked="" type="checkbox"/> the applicant <input type="checkbox"/> the inventor <input type="checkbox"/> the agent <input type="checkbox"/> the common representative   |   |   |   |                      |  |                      |  |                        |  |
| <b>Name and Address</b><br>BUCHANAN, Nigel<br>Beechtree Cottage<br>New Gilston<br>Fife KY8 5TF<br>United Kingdom   | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 2px;"> <b>State of Nationality</b><br/>                     GB                 </td> <td style="width: 50%; padding: 2px;"> <b>State of Residence</b><br/>                     GB                 </td> </tr> <tr> <td colspan="2" style="padding: 2px;"> <b>Telephone No.</b> </td> </tr> <tr> <td colspan="2" style="padding: 2px;"> <b>Facsimile No.</b> </td> </tr> <tr> <td colspan="2" style="padding: 2px;"> <b>Teleprinter No.</b> </td> </tr> </table> | <b>State of Nationality</b><br>GB   | <b>State of Residence</b><br>GB   | <b>Telephone No.</b> |  | <b>Facsimile No.</b> |  | <b>Teleprinter No.</b> |  |
| <b>State of Nationality</b><br>GB  | <b>State of Residence</b><br>GB   |   |   |                      |  |                      |  |                        |  |
| <b>Telephone No.</b>   |   |   |   |                      |  |                      |  |                        |  |
| <b>Facsimile No.</b>   |   |   |   |                      |  |                      |  |                        |  |
| <b>Teleprinter No.</b>   |   |   |   |                      |  |                      |  |                        |  |
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| <b>Name and Address</b><br>SMART TOOLS LIMITED<br>Beech Tree Cottage<br>New Gilston, By Leven<br>Fyfe KY8 5TF<br>United Kingdom  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 2px;"> <b>State of Nationality</b><br/>                     GB                 </td> <td style="width: 50%; padding: 2px;"> <b>State of Residence</b><br/>                     GB                 </td> </tr> <tr> <td colspan="2" style="padding: 2px;"> <b>Telephone No.</b> </td> </tr> <tr> <td colspan="2" style="padding: 2px;"> <b>Facsimile No.</b> </td> </tr> <tr> <td colspan="2" style="padding: 2px;"> <b>Teleprinter No.</b> </td> </tr> </table> | <b>State of Nationality</b><br>GB   | <b>State of Residence</b><br>GB   | <b>Telephone No.</b> |  | <b>Facsimile No.</b> |  | <b>Teleprinter No.</b> |  |
| <b>State of Nationality</b><br>GB  | <b>State of Residence</b><br>GB   |   |   |                      |  |                      |  |                        |  |
| <b>Telephone No.</b>   |   |   |   |                      |  |                      |  |                        |  |
| <b>Facsimile No.</b>   |   |   |   |                      |  |                      |  |                        |  |
| <b>Teleprinter No.</b>   |   |   |   |                      |  |                      |  |                        |  |
| 3. Further observations, if necessary:<br><b>The applicant identified in Box No.1 is to be considered as applicant/inventor for the purposes of US only, since he assigned his rights for all designated States except US to a new applicant as indicated below.</b>   |   |   |   |                      |  |                      |  |                        |  |
| 4. A copy of this notification has been sent to:<br><table style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <input checked="" type="checkbox"/> the receiving Office<br/> <input type="checkbox"/> the International Searching Authority<br/> <input checked="" type="checkbox"/> the International Preliminary Examining Authority                 </td> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> the designated Offices concerned<br/> <input checked="" type="checkbox"/> the elected Offices concerned<br/> <input type="checkbox"/> other:                 </td> </tr> </table> |   | <input checked="" type="checkbox"/> the receiving Office<br><input type="checkbox"/> the International Searching Authority<br><input checked="" type="checkbox"/> the International Preliminary Examining Authority | <input type="checkbox"/> the designated Offices concerned<br><input checked="" type="checkbox"/> the elected Offices concerned<br><input type="checkbox"/> other: |                      |  |                      |  |                        |  |
| <input checked="" type="checkbox"/> the receiving Office<br><input type="checkbox"/> the International Searching Authority<br><input checked="" type="checkbox"/> the International Preliminary Examining Authority  | <input type="checkbox"/> the designated Offices concerned<br><input checked="" type="checkbox"/> the elected Offices concerned<br><input type="checkbox"/> other:   |   |   |                      |  |                      |  |                        |  |

|  |  |
|--|--|
| <b>The International Bureau of WIPO</b><br>34, chemin des Colombettes<br>1211 Geneva 20, Switzerland<br><br>Facsimile No.: (41-22) 740.14.35 | <b>Authorized officer</b><br><br><div style="text-align: right;">Dominique DELMAS</div> Telephone No.: (41-22) 338.83.38 |
|--|--|

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# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

|   |   |   |
|---|---|---|
| Applicant's or agent's file reference<br><b>P25749A/LBA/SBL/JCO</b>   | <div style="display: flex; justify-content: space-between;"> <div> <b>FOR FURTHER ACTION</b> </div> <div>           See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)         </div> </div> |   |
| International application No.<br><b>PCT/GB00/01204</b>  | International filing date (day/month/year)<br><b>29/03/2000</b>   | Priority date (day/month/year)<br><b>29/03/1999</b> |
| International Patent Classification (IPC) or national classification and IPC<br><b>B25B13/52</b>  |   |   |
| Applicant<br><b>BUCHANAN, Nigel</b>   |   |   |
| <p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p>   |   |   |
| <p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the report</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input checked="" type="checkbox"/> Certain defects in the international application</li> <li>VIII <input type="checkbox"/> Certain observations on the international application</li> </ul> |   |   |
| Date of submission of the demand<br><br><b>17/10/2000</b>   | Date of completion of this report<br><br><b>28.06.2001</b>  |   |
| Name and mailing address of the international preliminary examining authority:<br><br><div style="display: flex; align-items: center;"> <div>             European Patent Office<br/>             D-80293 Munich<br/>             Tel. +49 89 2399 - 0 Tx: 523656 epmu d<br/>             Fax: +49 89 2399 - 4465           </div> </div>   | Authorized officer<br><br><b>Jeggy, T</b><br><br>Telephone No. +49 89 2399 7341   |   |



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**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/01204

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*):

**Description, pages:**

1-22 as originally filed

**Claims, No.:**

1-22 as originally filed

**Drawings, sheets:**

1/12-12/12 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

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**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/01204

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

|                               |      |        |                         |
|-------------------------------|------|--------|-------------------------|
| Novelty (N)                   | Yes: | Claims | 5, 7, 13-14, 16, 19-22  |
|                               | No:  | Claims | 1-4, 6, 8-12, 15, 17-18 |
| Inventive step (IS)           | Yes: | Claims |                         |
|                               | No:  | Claims | 1-22                    |
| Industrial applicability (IA) | Yes: | Claims | 1-22                    |
|                               | No:  | Claims |                         |

2. Citations and explanations  
**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

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**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**V.1 Cited documents**

Reference is made to the following documents :

- D1 : US-A-4 967 612 (R.SPARLING) 6 November 1990 (1990-11-06)
- D2 : US-A-2 435 329 (D.M.STAINPROOK) 3 February 1948 (1948-02-03)
- D3 : DE 16 03 767 A (DAIMLER-BENZ AG) 18 February 1971 (1971-02-18)
- D4 : US-A-1 464 128 (L.COES) 7 August 1923 (1923-08-07)
- D5 : US-A-1 666 353 (A.C.SCHELF) 17 April 1928 (1928-04-17)
- D6 : GB 235 434 A (A.I.MANCHO) 9 July 1925 (1925-07-09)
- D7 : US-A-1 610 387 (J.E.PENNINGTON) 14 December 1926 (1926-12-14)

**V.2 Claims 1-22**

The document D1 discloses (the references in parentheses applying to this document) a wrench having a head portion (27) adapted to engage and apply torque to a workpiece (11, Figure 1 ; Column 1, lines 6-8), said head portion (27) including a flexible ring portion (27) having an inner working surface (29) for engaging the workpiece (11, Figure 1) such that, when a torque is applied to said head (27) in a predetermined direction (33), said ring portion (27) closes around said workpiece (11 ; Column 3, lines 8-45 and more particularly lines 17-21 and 37-45)

The subject-matter of claim 1 is therefore not new (Article 33 (2) PCT).

Note that the subject-matter of claim 1 is also disclosed in D2 (Figure 1 ; Column 1, line 50 - Column 2, line 34), D3 (Figure 1 ; page 3 last paragraph) and in D4 (Figures 1-4 ; page 2, lines 13-33).

Dependent claims 2-4, 6, 8-12, 15 and 17-18 do not contain any features which, in combination with the features of any claim to which they refer, meet the require-

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ments of the PCT in respect of novelty (Article 33 (2) PCT), the reasons being as follows :

- Cl 2-4 : see D1, with cam surface 24. See also D2 with a convex cam surface 21. See also D4 only for claim 2
- Cl 6 : see D1, Figures 1, 3 and D2, Figure 1
- Cl 8-10 : see D1, Figure 1. See also D2, Figure 1 and D3, Figure 1 for a generally polygonal convex inner surface of the ring member (1, 2)
- Cl 11-12 : see D1, Figure 1 with reduced segments F-K (Figure 3)
- Cl 15 : see D3, Figure 1 and D4, Figure 1
- Cl 17-18 : see D1, Figure 1 with pivot 28. See also D2, Figure 1 with plurality of segments 17 and D3 with pivot 4

Dependent claims 5, 7, 13-14, 16 and 19-22 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Article 33 (3) PCT), the reasons being as follows :

- Cl 5 : One of the several possibilities given to the skilled person to increase the cooperation between the two contacting surfaces of a cam system
- Cl 7 : One of the several possibilities given to the skilled person to increase locally the hardness of a contacting point so that the efficiency of the cam system is increased
- Cl 13-14 : well-known constructions for the gripping parts in the technical field of wrenches to improve the contacts between the nut, bolt or screw and the head portions
- Cl 16 : One of the several possibilities given to the skilled person to allow the use of such a wrench in two opposite directions
- Cl 19 : see D6, Figures 1 and 3 with spring J
- Cl 20-22 : see D5, Figure 1 with flexible member A, segments 5, 6, yoke part defined by plates 13 (page 1, line 94 - page 2, line 2). Further features of claims 21-22 are just one of the several possibilities the skilled person would use with involving an inventive step to define such a wrench (see also D6, Figures 1 and 3 and D7, Figure 1)

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**Re Item VII**

**Certain defects in the international application**

VII.1 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 and D5 is not mentioned in the description, nor are these documents identified therein.

VII.2 Independent claim 1 is not in the two-part form in accordance with Rule 6 (3) (b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in the preamble (Rule 6 (3) (b) (i) PCT) and with the remaining features being included in the characterising part (Rule 6 (3) (b) (ii) PCT).

VII.3 The features of the claims are not provided with reference signs placed in parentheses (Rule 6 (2) (b) PCT).

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

|   |   |  |
|---|---|--|
| Applicant's or agent's file reference<br>P25749A/LBA/SBL/JCO                              | <b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |  |
| International application No.<br>PCT/GB00/01204   | International filing date (day/month/year)<br>29/03/2000  | Priority date (day/month/year)<br>29/03/1999 |
| International Patent Classification (IPC) or national classification and IPC<br>B25B13/52 |   |  |
| Applicant<br>[BUCHANAN, Nigel] SMART TOOLS LIMITED  |   |  |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.


2. This REPORT consists of a total of 6 sheets, including this cover sheet.

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These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

|   |  |
|---|--|
| Date of submission of the demand<br><br>17/10/2000  | Date of completion of this report<br><br>28.06.2001                      |
| Name and mailing address of the international preliminary examining authority:<br><br> European Patent Office<br>D-80298 Munich<br>Tel. +49 89 2399 - 0 Tx: 523656 epmu d<br>Fax: +49 89 2399 - 4465 | Authorized officer<br><br>Jeggy, T<br><br>Telephone No. +49 89 2399 7341 |



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# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/01204

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

### Description, pages:

1-22 as originally filed

### Claims, No.:

1-22 as originally filed

### Drawings, sheets:

1/12-12/12 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

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- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
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# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/01204

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

|                               |      |        |                         |
|-------------------------------|------|--------|-------------------------|
| Novelty (N)                   | Yes: | Claims | 5, 7, 13-14, 16, 19-22  |
|                               | No:  | Claims | 1-4, 6, 8-12, 15, 17-18 |
| Inventive step (IS)           | Yes: | Claims |                         |
|                               | No:  | Claims | 1-22                    |
| Industrial applicability (IA) | Yes: | Claims | 1-22                    |
|                               | No:  | Claims |                         |

2. Citations and explanations  
**see separate sheet**

## VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

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**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

---

International application No. PCT/GB00/01204

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**V.1 Cited documents**

Reference is made to the following documents :

D1 : US-A-4 967 612 (R.SPARLING) 6 November 1990 (1990-11-06)  
D2 : US-A-2 435 329 (D.M.STAINPROOK) 3 February 1948 (1948-02-03)  
D3 : DE 16 03 767 A (DAIMLER-BENZ AG) 18 February 1971 (1971-02-18)  
D4 : US-A-1 464 128 (L.COES) 7 August 1923 (1923-08-07)  
D5 : US-A-1 666 353 (A.C.SCHELF) 17 April 1928 (1928-04-17)  
D6 : GB 235 434 A (A.I.MANCHO) 9 July 1925 (1925-07-09)  
D7 : US-A-1 610 387 (J.E.PENNINGTON) 14 December 1926 (1926-12-14)

**V.2 Claims 1-22**

The document D1 discloses (the references in parentheses applying to this document) a wrench having a head portion (27) adapted to engage and apply torque to a workpiece (11, Figure 1 ; Column 1, lines 6-8), said head portion (27) including a flexible ring portion (27) having an inner working surface (29) for engaging the workpiece (11, Figure 1) such that, when a torque is applied to said head (27) in a predetermined direction (33), said ring portion (27) closes around said workpiece (11 ; Column 3, lines 8-45 and more particularly lines 17-21 and 37-45)

The subject-matter of claim 1 is therefore not new (Article 33 (2) PCT).

Note that the subject-matter of claim 1 is also disclosed in D2 (Figure 1 ; Column 1, line 50 - Column 2, line 34), D3 (Figure 1 ; page 3 last paragraph) and in D4 (Figures 1-4 ; page 2, lines 13-33).

Dependent claims 2-4, 6, 8-12, 15 and 17-18 do not contain any features which, in combination with the features of any claim to which they refer, meet the require-

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ments of the PCT in respect of novelty (Article 33 (2) PCT), the reasons being as follows :

- CI 2-4 : see D1, with cam surface 24. See also D2 with a convex cam surface 21. See also D4 only for claim 2
- CI 6 : see D1, Figures 1, 3 and D2, Figure 1
- CI 8-10 : see D1, Figure 1. See also D2, Figure 1 and D3, Figure 1 for a generally polygonal convex inner surface of the ring member (1, 2)
- CI 11-12 : see D1, Figure 1 with reduced segments F-K (Figure 3)
- CI 15 : see D3, Figure 1 and D4, Figure 1
- CI 17-18 : see D1, Figure 1 with pivot 28. See also D2, Figure 1 with plurality of segments 17 and D3 with pivot 4

Dependent claims 5, 7, 13-14, 16 and 19-22 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Article 33 (3) PCT), the reasons being as follows :

- CI 5 : One of the several possibilities given to the skilled person to increase the cooperation between the two contacting surfaces of a cam system
- CI 7 : One of the several possibilities given to the skilled person to increase locally the hardness of a contacting point so that the efficiency of the cam system is increased
- CI 13-14 : well-known constructions for the gripping parts in the technical field of wrenches to improve the contacts between the nut, bolt or screw and the head portions
- CI 16 : One of the several possibilities given to the skilled person to allow the use of such a wrench in two opposite directions
- CI 19 : see D6, Figures 1 and 3 with spring J
- CI 20-22 : see D5, Figure 1 with flexible member A, segments 5, 6, yoke part defined by plates 13 (page 1, line 94 - page 2, line 2). Further features of claims 21-22 are just one of the several possibilities the skilled person would use with involving an inventive step to define such a wrench (see also D6, Figures 1 and 3 and D7, Figure 1)

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**Re Item VII**

**Certain defects in the international application**

VII.1 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 and D5 is not mentioned in the description, nor are these documents identified therein.

VII.2 Independent claim 1 is not in the two-part form in accordance with Rule 6 (3) (b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in the preamble (Rule 6 (3) (b) (i) PCT) and with the remaining features being included in the characterising part (Rule 6 (3) (b) (ii) PCT).

VII.3 The features of the claims are not provided with reference signs placed in parentheses (Rule 6 (2) (b) PCT).

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/01204

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 B25B13/52 B25B13/04

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B25B B67B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No.      |
|----------|---|----------------------------|
| X        | US 4 967 612 A (R.SPARKLING)<br>6 November 1990 (1990-11-06)<br><br>column 3, line 8 - line 29; claim 1;<br>figures<br>---  | 1-3,6,8,<br>9,11,12,<br>17 |
| X        | US 2 435 329 A (D.M.STAINPROOK)<br>3 February 1948 (1948-02-03)<br>column 1, line 50 -column 2, line 34;<br>figure 1<br>--- | 1-4,6,8,<br>17,18          |
| X        | DE 16 03 767 A (DAIMLER-BENZ AG)<br>18 February 1971 (1971-02-18)<br>figure 1<br>---  | 1,2,8-10                   |
| X        | US 1 464 128 A (L.COES)<br>7 August 1923 (1923-08-07)<br>claims; figures<br>---   | 1,2                        |
|          | -/--  |                            |

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

**\* Special categories of cited documents :**

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"Z" document member of the same patent family

Date of the actual completion of the international search

12 July 2000

Date of mailing of the international search report

20/07/2000

Name and mailing address of the ISA

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Majerus, H

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/01204

| Patent document<br>cited in search report |   | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|---|---|---------------------|----------------------------|---------------------|
| US 4967612                                | A | 06-11-1990          | NONE                       |                     |
| US 2435329                                | A | 03-02-1948          | NONE                       |                     |
| DE 1603767                                | A | 18-02-1971          | NONE                       |                     |
| US 1464128                                | A | 07-08-1923          | NONE                       |                     |
| US 1666353                                | A | 17-04-1928          | NONE                       |                     |
| GB 235434                                 | A |                     | NONE                       |                     |
| US 1610387                                | A | 14-12-1926          | NONE                       |                     |

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# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

|  |   |  |
|--|---|--|
| Applicant's or agent's file reference                    | <b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. |  |
| International application No.<br><b>PCT/GB 00/ 01204</b> | International filing date (day/month/year)<br><b>29/03/2000</b>   | (Earliest) Priority Date (day/month/year)<br><b>29/03/1999</b> |
| Applicant<br><br><b>BUCHANAN, Nigel</b>                  |   |  |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

### 1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1

☐ None of the figures.

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INTERNATIONAL SEARCH REPORT

International application No.

91/GB 00/01204

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

LINE 2 - ...DELETE '(SUCH AS A NUT, BOLT OR SCREW)'  
LINES 10 TO 25 - ...DELETE COMPLETELY

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## INTERNATIONAL SEARCH REPORT

International Application No

P B 00/01204

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B25B13/52 B25B13/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B25B B67B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No.      |
|------------|---|----------------------------|
| X          | US 4 967 612 A (R.SPARLING)<br>6 November 1990 (1990-11-06)<br><br>column 3, line 8 - line 29; claim 1;<br>figures<br>---   | 1-3,6,8,<br>9,11,12,<br>17 |
| X          | US 2 435 329 A (D.M.STAINPROOK)<br>3 February 1948 (1948-02-03)<br>column 1, line 50 -column 2, line 34;<br>figure 1<br>--- | 1-4,6,8,<br>17,18          |
| X          | DE 16 03 767 A (DAIMLER-BENZ AG)<br>18 February 1971 (1971-02-18)<br>figure 1<br>---  | 1,2,8-10                   |
| X          | US 1 464 128 A (L.COES)<br>7 August 1923 (1923-08-07)<br>claims; figures<br>---   | 1,2                        |
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\* Special categories of cited documents :

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&amp;" document member of the same patent family

Date of the actual completion of the international search

12 July 2000

Date of mailing of the international search report

20/07/2000

Name and mailing address of the ISA:

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
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## INTERNATIONAL SEARCH REPORT

International Application No

P B 00/01204

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages                               | Relevant to claim No. |
|------------|--|-----------------------|
| A          | US 1 666 353 A (A.C.SCHELF)<br>17 April 1928 (1928-04-17)<br>page 1, line 94 -page 2, line 2; figure 1<br>----   | 14,20,21              |
| A          | GB 235 434 A (A.I.MANCHO)<br>9 July 1925 (1925-07-09)<br>page 1, line 55 - line 65; figure 1<br>----             | 19                    |
| A          | US 1 610 387 A (J.E.PENNINGTON)<br>14 December 1926 (1926-12-14)<br>page 1, line 73 - line 77; figure 1<br>----- | 14,20                 |

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/01204

| Patent document<br>cited in search report |   | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|---|---|---------------------|----------------------------|---------------------|
| US 4967612                                | A | 06-11-1990          | NONE                       |                     |
| US 2435329                                | A | 03-02-1948          | NONE                       |                     |
| DE 1603767                                | A | 18-02-1971          | NONE                       |                     |
| US 1464128                                | A | 07-08-1923          | NONE                       |                     |
| US 1666353                                | A | 17-04-1928          | NONE                       |                     |
| GB 235434                                 | A |                     | NONE                       |                     |
| US 1610387                                | A | 14-12-1926          | NONE                       |                     |

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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>7</sup>:

B25B 13/52, 13/04

A1

(11) International Publication Number:

WO 00/58057

(43) International Publication Date:

5 October 2000 (05.10.00)

(21) International Application Number: PCT/GB00/01204

(22) International Filing Date: 29 March 2000 (29.03.00)

(30) Priority Data:

9907059.1

29 March 1999 (29.03.99)

GB

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Beechtree Cottage, New Gilston, Fife KY8 5TF (GB).(74) Agent: MURGITROYD & COMPANY; 373 Scotland Street,  
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(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

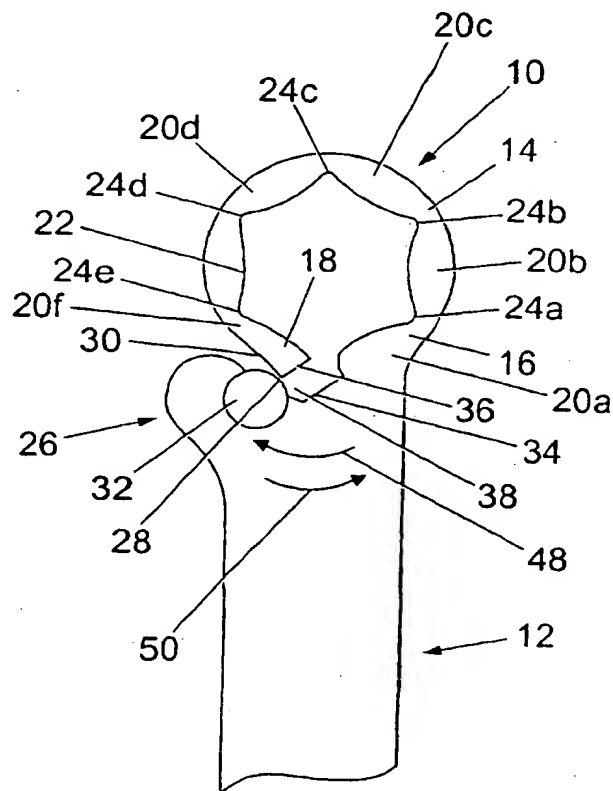
Published

With international search report.

(54) Title: WRENCH

(57) Abstract

A wrench has a head portion (10) adapted to engage and apply torque to a workpiece, including a ring member (14) which surrounds the workpiece and has a fixed end (16) and a free end (18) such that, when the ring engages a workpiece and a torque is applied in a predetermined direction (48), the ring closes around the workpiece, increasing the grip between the wrench and the workpiece even if the workpiece is substantially worn, damaged or undersized.



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1     Wrench

2  
3     The present invention relates to wrenches (also known  
4     as "spanners", particularly in the United Kingdom), and  
5     in particular to "ring" wrenches.  
6

7     A wrench is a tool for applying torque to a nut, bolt,  
8     screw or the like (hereinafter referred to, for  
9     convenience, as a "workpiece") for the purpose of  
10    tightening or slackening the workpiece. The wrench has  
11    a head portion shaped to engage the periphery of the  
12    workpiece in a non-rotatable manner such that a force  
13    applied to rotate the head transmits torque to the  
14    workpiece. The workpiece generally has a polygonal  
15    shape, typically hexagonal or square, and the head of  
16    the wrench has a complementary shape and size. The head  
17    of a ring wrench is configured to substantially  
18    surround the periphery of the workpiece.  
19

20    The following description will refer particularly to  
21    wrenches for use with hexagonal nuts. However, it will  
22    be understood that the invention is equally applicable

1 to wrenches and corresponding nuts having other shapes  
2 and to other types of workpiece such as bolts and  
3 screws.

4  
5 A conventional ring wrench has a ring-shaped head with  
6 a hexagonally shaped inside surface, each section of  
7 which is substantially flat. In use, the flat surfaces  
8 and corners on the inner surface of the head engage the  
9 flat surfaces and corners of the nut to be tightened or  
10 slackened. When the head is rotated in the appropriate  
11 direction the nut is slackened or tightened as  
12 required. However if the nut is undersized, damaged or  
13 worn, it is very likely that the head will 'slip' and  
14 rotate around the nut instead of properly gripping or  
15 engaging the flats and corners of the nut.

16  
17 It is an object of the present invention to provide an  
18 improved wrench with which workpieces that are  
19 undersized, damaged or worn can be reliably engaged by  
20 the wrench for applying a torque thereto.

21  
22 In accordance with the invention there is provided a  
23 wrench having a head portion adapted to engage and  
24 apply torque to a workpiece, said head portion  
25 including a flexible ring portion having an inner  
26 working surface for engaging the workpiece, such that,  
27 when a torque is applied to said head in a  
28 predetermined direction, said ring portion closes  
29 around said workpiece.

30

31

1 Preferably, said head portion is adapted to engage and  
2 apply torque to a workpiece, said head portion  
3 including a ring member adapted to substantially  
4 surround a peripheral surface of a workpiece and having  
5 a first, fixed end and a second, free end such that,  
6 when an inner surface of said ring member engages a  
7 workpiece and a torque is applied to said head portion  
8 in a predetermined direction, said ring member closes  
9 around said workpiece.

10

11 Preferably, said wrench further includes a first cam  
12 surface disposed adjacent an outer surface of a free  
13 end portion of said ring such that, when said inner  
14 surface of said ring member engages said workpiece and  
15 said torque is applied to said head portion in said  
16 predetermined direction, said first cam surface presses  
17 against said outer surface of said free end portion of  
18 said ring.

19

20 Preferably also, said first cam surface is generally  
21 convex.

22

23 Preferably also, said outer surface of said free end  
24 portion is generally concave.

25

26 Optionally, said first cam surface is formed integrally  
27 with said wrench or said first cam surface is provided  
28 by an insert.

29

30 Preferably, said ring member comprises a plurality of  
31 segments.

32

1 Preferably also, said segments define a generally  
2 polygonal inner surface of said ring member.

3

4 Preferably also, each of said segments has an inner  
5 surface which is generally convex in the  
6 circumferential direction of said ring member.

7

8 Preferably, at least some of said segments are formed  
9 integrally with one another and said ring member is  
10 adapted to deform resiliently at junctions between  
11 adjacent, integrally formed segments.

12

13 Preferably also, said junctions between adjacent,  
14 integrally formed rings have a reduced thickness in the  
15 radial direction as compared with the remainder of said  
16 segments.

17

18 Preferably also, said junctions comprise portions of  
19 the inner surface of said ring member which are  
20 generally concave in the circumferential direction of  
21 said ring member.

22

23 Optionally, the inner surface of said ring member is  
24 corrugated.

25

26 Preferably, said head portion includes means for  
27 limiting movement of said free end of said ring member  
28 relative to said fixed end thereof in said  
29 predetermined direction.

30

31 Preferably, said head portion includes means for  
32 limiting movement of said free end of said ring member

1 relative to said fixed end thereof in a direction  
2 opposite to said predetermined direction.  
3

4 Preferably, said head portion includes hinge means  
5 whereby at least a portion of said ring member may be  
6 pivoted in the plane of said ring member relative to  
7 the remainder of said head portion.  
8

9 Preferably also, said ring member comprises a plurality  
10 of segments and said hinge means is located between at  
11 least one pair of adjacent segments.  
12

13 Preferably also, the wrench includes resilient bias  
14 means associated with said hinge means and adapted to  
15 bias said ring member towards a closed position.  
16

17 In an alternative embodiment, ring portion is pivotably  
18 connected to a yoke portion of said head and comprises  
19 a plurality of segments interconnected by an elongate  
20 flexible member having first and second free ends  
21 secured to said yoke portion such that pivoting  
22 movement of said ring relative to said yoke in a  
23 predetermined direction causes a length of said  
24 elongate flexible member passing around said ring to be  
25 shortened and the ring to close.  
26

27 Preferably, first and second segments of said ring are  
28 formed integrally with one another as part of a pivot  
29 member pivotably mounted in said yoke by means of a  
30 pivot pin and the remainder of said segments are formed  
31 as discrete members, said flexible elongate member  
32 being threaded through said remainder of said segments

1 and the free ends thereof passing around an outer  
2 surface of said pivot member and around said pivot pin.

3  
4 Preferably also, the first free end of the flexible  
5 elongate member extends from one of said discrete  
6 segments, passes around one part of said outer surface  
7 of said pivot member opposite an inner surface thereof  
8 defining a first segment, over the top of, around and  
9 under the pivot pin, and out of the front of the yoke  
10 portion, and wherein the second free end of the of the  
11 elongate flexible member extends from another of said  
12 discrete segments, passes around a second part of said  
13 outer surface of the pivot member opposite an inner  
14 surface thereof defining a second segment, under the  
15 first free end and the pivot pin, and out of the front  
16 of the yoke portion.

17  
18 Embodiments of the invention will now be described, by  
19 way of example only, with reference to the accompanying  
20 drawings in which:

21  
22 Fig. 1 is a front elevation of a head portion of a  
23 first embodiment of a wrench in accordance with the  
24 present invention;

25  
26 Figs. 2a, 2b and 2c are front elevations of examples of  
27 dual-head wrenches of different sizes in accordance  
28 with the embodiment of Fig. 1;

29  
30 Fig. 3a illustrates in perspective the wrench of Fig. 1  
31 gripping a worn nut and Fig.3b shows a perspective view  
32 of the worn nut of Fig. 3a;

1

2 Fig. 4a is a front elevation of a head portion of a  
3 second embodiment of a wrench in accordance with the  
4 present invention, and Fig.4b is an end elevation the  
5 wrench of Fig.4a;

6

7 Fig. 5 is a front elevation of a head portion of a  
8 third embodiment of a wrench in accordance with the  
9 present invention;

10

11 Figs. 6a-6d are front elevations of a head portion of a  
12 fourth embodiment of a wrench in accordance with the  
13 present invention in which head is hinged, Fig. 6a  
14 showing the head in its working position and Figs. 6b,  
15 6c and 6d showing the head rotated by different angles  
16 about the hinge;

17

18 Fig. 7 is a front elevation of the head portion of a  
19 fifth embodiment of a wrench in accordance with the  
20 present invention in which the head is hinged;

21

22 Fig. 8 is a front elevation of the head portion of a  
23 sixth embodiment of a wrench in accordance with the  
24 present invention in which the head is hinged, and in  
25 which the hinge is provided by a ball and socket joint;

26

27 Fig. 9 is a front elevation of the head portion of a  
28 seventh embodiment of a wrench in accordance with  
29 the present invention in which the head is hinged, and  
30 in which the hinge is provided by a knuckle joint;

31

1 Figs. 10a-10c are front elevations of the head portion  
2 of an eighth embodiment of a wrench in accordance with  
3 the present invention, in which the head is hinged, Fig  
4 10c showing the head in its working position and Figs.  
5 10a and 10b showing the head in fully and partially  
6 open positions;

7

8 Figs. 11a and 11b are front elevations of the head  
9 portion of a ninth embodiment of a wrench in accordance  
10 with the present invention in which the head includes  
11 multiple hinges, Fig.11a showing the head in its  
12 working position and Fig. 11b showing the head in an  
13 open position, and Fig.11c is a side elevation the  
14 wrench of Fig.11a;

15

16 Figs. 12a-12e are front elevations of the head portion  
17 of tenth embodiment of a wrench in accordance with the  
18 present invention, in which the head is hinged by means  
19 of a chain link interconnecting two portions of the  
20 head, Fig. 12a showing the head in its working position  
21 and Figs. 12b-12e showing the head rotated by different  
22 angles about the hinge, and Figs. 12f-12h are  
23 perspective views illustrating the chain link of Figs.  
24 12a-12e;

25

26 Figs. 13a and 13b are front elevations of the head  
27 portion of an eleventh embodiment of a wrench in  
28 accordance with the invention, in which the head is  
29 hinged by means of a chain link and incorporating  
30 resilient bias means, and Fig. 13c is a front elevation  
31 of a chain link incorporating integral resilient bias  
32 elements;

1

2 Fig. 14 is a front elevation of the head portion of a  
3 twelfth embodiment of a wrench in accordance with the  
4 present invention; and

5

6 Fig. 15a is a side elevation, partly in section, of a  
7 thirteenth embodiment of the present invention and Fig.  
8 15b is an exploded perspective view of components of  
9 the wrench of Fig. 15a.

10

11 The embodiments of the invention will now be described  
12 with reference to the drawings. In the various  
13 embodiments and corresponding drawings, like reference  
14 numerals will be used to indicate like features.

15

16 Referring now to Fig. 1 of the drawings, a wrench in  
17 accordance with the invention includes a head portion  
18 10 connected to a shaft or handle 12. The head portion  
19 10 is in the form of a ring 14 intended to  
20 substantially surround the peripheral surface of a  
21 workpiece such as a nut, bolt or screw. In use, the  
22 inner surface of the head 10 engages the peripheral  
23 surface of the workpiece. Fig. 1 shows the wrench in  
24 its "rest" condition, with no torque applied.

25

26 The ring 14 has a first, fixed end 16 connected to the  
27 shaft 12 and a second, free end 18 which terminates  
28 close to the first end 16 but which is not connected  
29 thereto or to the shaft 12. In this embodiment, the  
30 ring 14 is divided into segments 20a-f corresponding in  
31 number to the number of faces of the peripheral surface  
32 of the workpiece with which the wrench is intended to

1 be used, such that the inner surface of the ring 14 has  
2 a generally polygonal configuration. Preferably, the  
3 inner surface 22 of each segment 20a-f is generally  
4 convex, such that the thickness of the ring 14 varies  
5 around its circumference, being thinnest at the  
6 junctions 24a-e between adjacent segments. Preferably  
7 also, the junctions 24a-e are radiused (concave). The  
8 free end 18 comprises part of the end segment 20f of  
9 the ring 14.

10

11 The head 10 further includes a cam portion 26 located  
12 radially outwards from the end segment 20f of the ring  
13 14 and defining a first cam surface 28 adapted to co-  
14 operate with a second cam surface 30 provided by the  
15 outer surface of the end segment 20f of the ring 14.  
16 The first cam surface 28 is preferably generally convex  
17 and the second cam surface 30 is preferably generally  
18 concave (such that the outer surface of the end segment  
19 20f of the ring is configured as a decreasing ramp).  
20 The first cam surface 28 may be provided by an insert  
21 in the cam portion 26 such as a cylindrical pin or  
22 roller 32. Adjacent the cam portion 26 there is  
23 provided an abutment surface 34, generally parallel to  
24 an end surface 36 of the free end 18 of the ring 14 and  
25 spaced therefrom by a gap 38.

26

27 Figs. 2a to 2c show a set of dual-head wrenches 40  
28 incorporating the head design illustrated in Fig. 1.  
29 As in the case of conventional wrenches, wrenches in  
30 accordance with the present invention may be provided  
31 in a variety of sizes to suit standard workpiece sizes,  
32 with single or dual heads. A dual-head wrench could

1 incorporate a first head in accordance with the  
2 invention and a second conventional head.

3  
4 Fig. 3b illustrates a nut 42 engaging a bolt 44, and  
5 Fig. 3a shows the wrench of Fig. 1 engaging the nut 42.  
6 It is common for the nuts, bolt heads etc to become  
7 worn in use, so that the corners 46 of the nut between  
8 its peripheral faces wear flat as shown in Fig. 3b.  
9 The head of a conventional wrench will tend to slip  
10 around a worn nut of this type.

11  
12 When a wrench in accordance with the present invention  
13 is engaged with a nut 6 as shown in Fig. 3a and a force  
14 applied to the head in the direction of the arrow 48  
15 (i.e. in the direction defined by the shortest distance  
16 between the fixed end 16 and the free end 18 of the  
17 ring) then, assuming that a certain minimal degree of  
18 friction is generated between the inner surface of the  
19 ring and the nut 42, the ring 14 will deform and tend  
20 to close around the nut 42, progressively tightening  
21 the grip between the ring 14 and the nut 42 and  
22 preventing any slippage even if the nut 42 is  
23 significantly worn, damaged or undersized.

24  
25 In more detail, when torque is applied to the wrench in  
26 the direction shown by the arrow 48, this causes the  
27 first cam surface 28 to press against the second cam  
28 surface 30, pushing the free end 18 of the ring 14  
29 inwards towards the nut 42. The torque applied when  
30 the shaft is first turned causes a force to be applied  
31 radially inwards from the free end 18 onto the nut 42.  
32 This force effectively wedges the free end 18 against

1 the nut 42. When further torque applied, the wrench  
2 shaft and ring are pulled around in the direction 48  
3 such that the cam moves along the second cam surface 30  
4 in the direction shown by arrow 48. The shape of the  
5 second cam surface 30 also means that the abutting  
6 surface 36 of the end segment 20f of the ring 14 moves  
7 towards the abutment 34, narrowing the gap 38.

8  
9 In effect, the ring is being stretched from the  
10 position of the last segment 20f which is secured  
11 against the nut. The force transmitted around the ring  
12 14 also acts to deform the ring at the segment  
13 junctions 24a-e. The convex shape of inner surfaces 22  
14 of the ring segments 20a-f also serve to enhance the  
15 grip between the ring 14 and the peripheral surfaces of  
16 the workpiece. Even if the workpiece is damaged, worn  
17 or undersized, providing there is sufficient initial  
18 contact and friction between the ring and the  
19 workpiece, the ring 14 will deform inwards to provide  
20 increased grip enabling further torque to be applied to  
21 rotate the workpiece.

22  
23 In the embodiments of Figs. 1 to 3, the junctions 24a-e  
24 between adjacent segments 20a-f of the ring 14 provide  
25 "integral hinges", allowing the ring to deform  
26 elastically and close around the workpiece. The  
27 surfaces 34 and 36 limit the deformation of the ring 14  
28 when torque is applied in the direction of the arrow  
29 48. However, if torque was applied in the opposite  
30 direction (arrow 50 in Fig. 1), there is a risk that  
31 the ring 14 would be damaged by being deformed  
32 plastically.

1

2 Figs. 4a and 4b illustrate a further embodiment of the  
3 invention which is similar to that of Fig. 1 except  
4 that the head 10 includes means for preventing the ring  
5 14 from opening excessively if the head 10 is rotated  
6 in the direction indicated by the arrow 50. The free  
7 end 18 of the ring 14 is provided with an outward  
8 projection 52 which co-operates with a corresponding  
9 recess 54 formed in the cam portion 26. In this  
10 example, the insert 32 of Fig. 1 is omitted and the  
11 first cam surface 28 is formed integrally with the cam  
12 portion 26.

13

14 Fig. 5 illustrates a further embodiment similar to Fig.  
15 1 and Fig. 2, with a different configuration of a catch  
16 arrangement to prevent opening of the ring. In this  
17 example, the free end 56 of the end segment 20f of the  
18 ring 14 is extended and is accommodated by a notch or  
19 channel 58 formed in the head portion 10 adjacent the  
20 cam portion 26. The extended free end 56 and notch 58  
21 co-operate to limit movement of the end segment 20f of  
22 the ring 14 both in the direction of the arrow 48 and  
23 in the direction of the arrow 50. Other equivalent  
24 arrangements may be employed in these or any of the  
25 other embodiments of the invention to limit movement of  
26 the end segment 20f in either or both of the directions  
27 48 and 50.

28

29 The embodiment of Fig. 5 again includes an insert 32  
30 which provides the first cam surface 28 of the wrench.  
31 It will be understood that an insert of this type may  
32 be included in any of the embodiments of the invention,

1 or the first cam surface 28 may be formed as an  
2 integral part of the head of the wrench in any of the  
3 embodiments of the invention.

4  
5 In the embodiments described thus far, the head of the  
6 wrench comprises a substantially closed ring which, in  
7 use, substantially surrounds the workpiece. As with  
8 conventional ring-type wrenches, this arrangement means  
9 that, in certain circumstances, it may be difficult or  
10 impossible for the wrench to engage a particular  
11 workpiece.

12  
13 Figs 6a-6d illustrate a further embodiment of the  
14 present invention in which the ring defined by the head  
15 of the wrench is provided with a hinge or pivot 60,  
16 enabling the ring 14 to be opened in order to engage a  
17 workpiece. In this example, the hinge 60 is provided  
18 at the junction 24a between first and second segments  
19 adjacent the fixed end 16 of the ring 14. Fig. 6a  
20 shows the ring closed, in position for use. Figs. 6b,  
21 6c and 6d illustrate the use of the hinge 60 to open  
22 the ring 14. This embodiment is particularly useful  
23 where the ring 14 of the wrench is to be fitted around,  
24 for example, a nut located on a length of pipe. The  
25 hinge 60 allows the ring 14 to be opened out to allow  
26 it to be easily fitted around the workpiece. This has  
27 particular advantages over traditional closed ring  
28 wrenches which cannot be used if the ring cannot be  
29 fitted over the end of the pipe to be positioned on the  
30 nut. Once in position, the wrench of the present  
31 invention can be used to tighten or loosen the nut or  
32 bolt as previously described.

1

2 Fig.7 shows a wrench in accordance with the present  
3 invention similar to that of Figs 6 a-d, but with an  
4 integral first cam surface 28 rather than an insert. In  
5 this example also, the convex inner surfaces 22 of the  
6 ring segments 20a-f have less curvature than in the  
7 embodiment of Fig.1. This provides a larger surface  
8 area of contact between these surfaces and the surfaces  
9 of the workpiece. In addition, the junctions 24a-e are  
10 radiused so as to be substantially semicircular in  
11 profile.

12

13 Fig.8 shows further embodiment of a wrench in  
14 accordance with present invention, similar to that of  
15 Figs 6 a-d, but with a hinge provided by ball and  
16 socket joint 62 which, in this example, is located  
17 between the second and third ring segments 20b,20c.

18 Fig. 9 shows a wrench in accordance with the present  
19 invention similar to that of Figs 6 a-d, with a knuckle  
20 joint 64 providing a hinge between the first and second  
21 ring segments 20a,20b. This embodiment is shown in its  
22 working position, where a torque is to be applied in  
23 the direction shown by arrow 48, such that the free end  
24 18 of the ring 14 moves freely towards the abutment 34.  
25 The extent of this free movement is determined by a gap  
26 66 formed by the knuckle joint between the adjacent  
27 ring segments 20a,20b. Once this gap 66 has been  
28 closed, any additional torque will cause the ring 14 to  
29 deform and the area inside the ring to decrease. The  
30 abutment of the segments 20a,20b provides additional  
31 leverage.

32

1 Figs. 10a, 10b and 10c show a wrench in accordance with  
2 the present invention similar to that of Figs 6 a-d,  
3 with an extended ball and socket joint 68 providing a  
4 hinge between the second and third ring segments  
5 20b,20c. This figure also shows the extent to which the  
6 ring 14 may be opened to allow an object to be fitted  
7 inside the ring. As with Fig. 9, the ring 14 moves  
8 freely until an extension portion 71 of the ball and  
9 socket joint 68, connected to the third ring segment  
10 20c, abuts against the outer surface of the second ring  
11 segment 20b. Thereafter, the area inside the ring is  
12 decreased by deformation of the ring about the  
13 junctions 24c-e between the segments 20c-f.

14  
15 Figs. 11a, 11b and 11c illustrate a further embodiment  
16 of the present invention in which pivot hinges 72 are  
17 provided between each of the segments 20a-f of the ring  
18 14.

19  
20 In use, the wrench illustrated in Figs. 11a, 11b and  
21 11c allows the ring 14 to be opened out as shown in  
22 Fig. 11b because each of the segments is rotatable  
23 about the hinges 72. This again allows the wrench to  
24 be positioned around a nut or bolt located on a length  
25 of pipe.

26  
27 Whilst the above examples describe a ring inner surface  
28 which is substantially hexagonal in shape, in its  
29 working position, further examples of the present  
30 invention are envisaged in which the inner surface is  
31 triangular, square, pentagonal, heptagonal, octagonal,

1 nonagonal, decagonal or having a larger number of  
2 sides.

3  
4 Figs 12a-e illustrate a further embodiment of the  
5 present invention in which the third and fourth ring  
6 segments 20c, 20d are hingeably connected by a chain  
7 link 74. The term "chain link" as used herein means an  
8 arrangement in which a plate member 76 having a figure-  
9 of-eight configuration is disposed on either side of  
10 the ring 14 and pivot pins 78 extend between the plates  
11 76 through bores formed at the ends of the adjacent  
12 ring segments 20c, 20d. This is a preferred form of  
13 hinge for use in accordance with the present invention  
14 and may be employed to interconnect one or more pairs  
15 of ring segments other than or in addition to the third  
16 and fourth segments as shown in this embodiment. Fig.  
17 12a shows the wrench in its working position (closed)  
18 and Figs. 12b-e show the ring 14 progressively opening  
19 from the working position. Figs. 12f to 12h illustrate  
20 the chain link 74 in more detail. Fig. 12f is an  
21 exploded view of the chain link 74, also including a  
22 spring clip 79 which would normally be included in a  
23 chain link of this type. Fig. 12g shows the ring 14  
24 hinged open and Fig. 12h shows the ring 14 hinged  
25 closed.

26  
27 Figs. 13a and 13b show a further embodiment of the  
28 invention, similar to that of Figs. 12a-e, in which the  
29 chain link hinge 74 is provided with resilient bias  
30 means comprising spring elements 80 which tend to urge  
31 the ring 14 towards its normal closed, working  
32 position, illustrated in Fig. 13a. The combination of

1 the hinge and resilient bias means generally provides a  
2 junction between the adjacent ring sections connected  
3 by the hinge 74 (segments 20c, 20d in this preferred  
4 example) which is more flexible than the "integral  
5 hinges" provided by the junctions 24a, b, d, e between the  
6 other pairs of adjacent segments. The use of such  
7 resilient bias means that the wrench operates in a  
8 substantially identical manner to that of the  
9 embodiment of Fig. 1 when rotated in the direction 48.  
10 However, when rotated in the opposite direction 50, the  
11 resilient bias means associated with the hinge 74  
12 allows the ring 14 to open slightly so that the ring 14  
13 may rotate relative to the workpiece, thereby providing  
14 a type of ratchet mechanism so that the wrench does not  
15 need to be removed from the workpiece between  
16 successive strokes in the "working direction" 48. The  
17 bias means allows the ring to rotate relative to the  
18 workpiece on the return stroke, and urges the ring  
19 segments back into their working position for the next  
20 working stroke.

21  
22 In this example, the spring elements 80 are formed  
23 integrally with the plates 76 of the chain link 74,  
24 comprising resilient arms 82 which extend from either  
25 end of the plates 76, curving in the plane of the  
26 plates 76 around the outer ends thereof, and having end  
27 portions 84 which are bent out of the plane of the  
28 plates 76. When the plates 76 are located on either  
29 side of the ring segments 20c, 20d, the end portions 84  
30 of the arms 82 project into and engage with apertures  
31 86 formed in the side faces of the adjacent ring  
32 segments 20c, 20d.

1

2 The ring 14 may be opened against the return force of  
3 the spring elements 80 as seen in Fig. 13b, allowing  
4 the wrench to engage, for example, a nut located on a  
5 length of pipe, as in the previous embodiments of the  
6 invention incorporating hinged rings.

7

8 It will be understood that different types of resilient  
9 bias means may be incorporated into chain link hinges  
10 of the type employed in the embodiments of Figs. 12 and  
11 13, or into other types of hinges.

12

13 Fig 14 shows a further embodiment of the present  
14 invention in which the inside surface of the ring 14 is  
15 substantially circular, rather than polygonal. The  
16 inner surface of the ring 14 is provided with  
17 corrugations or serrations 90 which grip the workpiece  
18 inside the ring on application of a torque. The ring  
19 14 as a whole is sufficiently flexible to deform and  
20 close around the workpiece. The size, shape and  
21 distribution of the corrugations 90 will depend on the  
22 nature of the intended workpiece. This embodiment may  
23 also be modified to incorporate variations of the cam  
24 surfaces, stops and catches, hinges etc. described in  
25 relation to previous embodiments. Also, the segmented  
26 rings of previous embodiments may be provided with  
27 serrations or corrugations on their inner surfaces.

28

29 Figs. 15a and 15b show a further alternative embodiment  
30 of a wrench in accordance with the present invention,  
31 again comprising an assembly 110 and a shaft 112.

32

1 In this embodiment, the head 110 comprises a ring  
2 assembly 114 which consists of a generally V-shaped  
3 member 200, the inner surfaces which define first and  
4 second segments 120a and 120b of the ring, and a  
5 plurality of discrete segments 120c-f. The V-shaped  
6 member 200 and the segments 120c-f are interconnected  
7 by an elongate, substantially inelastic, flexible  
8 member 202, such as a strap or the like (suitably  
9 formed from metal, plastics, leather or textile  
10 material) which is threaded through the segments 120c-  
11 f. The head 110 further includes a yoke portion 204  
12 formed at the upper end of the shaft 112. The V-shaped  
13 member is pivotably mounted in the yoke portion 204 by  
14 means of a pivot pin 206 which extends through yoke  
15 apertures 208 and complementary apertures 210 formed  
16 adjacent the apex of the V-shaped member 200.

17

18 The outer surface of the V-shaped member 200 is formed  
19 with a channel 212, defining a saddle surface 214  
20 extending between two lug portions 216 which contain  
21 the apertures 210. The strap 202 has first and second  
22 free ends 202a and 202b. The first free end 202a of  
23 the strap 202 extends from the segment 120f, passes  
24 around one half of the saddle surface 214 opposite the  
25 segment surface 120a, over the top of, around and under  
26 the pivot pin 206, and out of the front of the yoke  
27 portion 204. The second free end 202b of the of the  
28 strap 202 extends from the segment 120c, passes around  
29 the second half of the saddle surface 214 opposite the  
30 segment surface 120b, under the first free end 202a and  
31 the pivot pin 206, and out of the front of the yoke  
32 portion 204. Both of the free ends 202a and 202b are

1     secured to the front of the yoke portion 204 by any  
2     suitable means such as rivets 218 engaging apertures  
3     220.

4  
5     In use, the ring assembly 114 is placed over the  
6     workpiece. When torque is applied to the yoke 204 in  
7     the direction of the arrow 148, the yoke 204 pivots  
8     relative to the V-shaped member 200, pulling on the  
9     second free end 202b of the strap 202 so that the trap  
10    202 is pulled through the segments 120c-f, closing the  
11    ring 114 about the workpiece by decreasing the  
12    circumference of the head ring 114 and tightening the  
13    grip of the ring 114 around the workpiece. Further  
14    torque applied to the shaft allows the workpiece to be  
15    rotated with the head of the wrench.

16  
17    It will be appreciated that the extent of tightening of  
18    the strap per unit angle through which the shaft has  
19    been turned in the direction of arrow 148 is dependent  
20    upon the circumference of the pivot pin 206. A larger  
21    pin circumference will tighten the strap by turning the  
22    shaft through a smaller angle than would be required  
23    where the pin circumference is smaller.

24  
25    If torque is applied opposite to the direction of the  
26    arrow 148, the angle between the head and the shaft is  
27    changed such that the strap is loosened to allow the  
28    head 122 to be fitted over larger workpieces. The  
29    wrench 100 is operated as before, by turning the shaft  
30    in the direction of arrow 124. This embodiment  
31    therefore provides additional flexibility by allowing  
32    the wrench to be used on differently sized work pieces

1 depending on the initial angle between the shaft and  
2 the head. The arrangement may also allow the ring 114  
3 to ratchet about the workpiece on return strokes  
4 between working strokes, as previously described in  
5 relation to other embodiments of the invention.

6

7 Improvements and modifications may be incorporated  
8 without departing from the scope of the invention as  
9 defined in the Claims appended hereto.

1     CLAIMS

2

3     1.     A wrench having a head portion (10,110) adapted to  
4     engage and apply torque to a workpiece (42), said head  
5     portion (10,110) including a flexible ring portion  
6     (14,114) having an inner working surface for engaging  
7     the workpiece (42), such that, when a torque is applied  
8     to said head (10,110) in a predetermined direction  
9     (48,148), said ring portion closes around said  
10    workpiece (42).

11

12    2.     A wrench as claimed in Claim 1 having a head  
13    portion (10) adapted to engage and apply torque to a  
14    workpiece (42), said head portion (10) including a ring  
15    member (14) adapted to substantially surround a  
16    peripheral surface of a workpiece (42) and having a  
17    first, fixed end (16) and a second, free end (18) such  
18    that, when an inner surface of said ring member (14)  
19    engages a workpiece (42) and a torque is applied to  
20    said head portion (10) in a predetermined direction  
21    (48), said ring member (14) closes around said  
22    workpiece (42).

23

24    3.     A wrench as claimed in Claim 2, wherein said  
25    wrench further includes a first cam surface (28)  
26    disposed adjacent an outer surface (30) of a free end  
27    portion of said ring (14) such that, when said inner  
28    surface of said ring member (14) engages said workpiece  
29    (42) and said torque is applied to said head portion  
30    (10) in said predetermined direction (48), said first  
31    cam surface presses against said outer surface (30) of  
32    said free end portion of said ring (14).

1

2 4. A wrench as claimed in Claim 3, wherein said first  
3 cam surface (28) is generally convex.

4

5 5. A wrench as claimed in Claim 3 or Claim 4, wherein  
6 said outer surface (30) of said free end portion is  
7 generally concave.

8

9 6. A wrench as claimed in any one of Claims 3 to 5,  
10 wherein said first cam surface (28) is formed  
11 integrally with said wrench.

12

13 7. A wrench as claimed in any one of Claims 3 to 5,  
14 wherein said first cam surface (28) is provided by an  
15 insert (32).

16

17 8. A wrench as claimed in any any one of Claims 2 to  
18 7, wherein said ring member (14) comprises a plurality  
19 of segments (20a-f).

20

21 9. A wrench as claimed in Claim 8, wherein said  
22 segments (20a-f) define a generally polygonal inner  
23 surface of said ring member (14).

24

25 10. A wrench as claimed in Claim 8 or Claim 9, wherein  
26 each of said segments (20a-f) has an inner surface  
27 which is generally convex in the circumferential  
28 direction of said ring member (14).

29

30 11. A wrench as claimed in any one of Claims 8 to 10,  
31 wherein at least some of said segments (20a-f) are  
32 formed integrally with one another and said ring member

1 (14) is adapted to deform resiliently at junctions  
2 (24a-e) between adjacent, integrally formed segments.  
3

4 12. A wrench as claimed in Claim 11, wherein said  
5 junctions (24a-e) between adjacent, integrally formed  
6 rings have a reduced thickness in the radial direction  
7 as compared with the remainder of said segments (20a-  
8 f).  
9

10 13. A wrench as claimed in Claim 12, wherein said  
11 junctions (24a-e) comprise portions of the inner  
12 surface of said ring member which are generally concave  
13 in the circumferential direction of said ring member  
14 (14).  
15

16 14. A wrench as claimed in any one of Claims 2 to 13,  
17 wherein the inner surface of said ring member is  
18 corrugated.  
19

20 15. A wrench as claimed in any one of Claims 2 to 14,  
21 wherein said head portion (10) includes means for  
22 limiting movement of said free end (18) of said ring  
23 member (14) relative to said fixed end (16) thereof in  
24 said predetermined direction (48).  
25

26 16. A wrench as claimed in any one of Claims 2 to 15,  
27 wherein said head portion (10) includes means for  
28 limiting movement of said free end (18) of said ring  
29 member (14) relative to said fixed end (16) thereof in  
30 a direction (50) opposite to said predetermined  
31 direction (48).  
32

1 17. A wrench as claimed in any one of Claims 2 to 16,  
2 wherein said head portion (10) includes hinge means  
3 (60, 62, 64, 68, 72, 74) whereby at least a portion of  
4 said ring member (14) may be pivoted in the plane of  
5 said ring member (14) relative to the remainder of said  
6 head portion (10).

7  
8 18. A wrench as claimed in Claim 17, wherein said ring  
9 member comprises a plurality of segments (20a-f) and  
10 wherein said hinge means (60, 62, 64, 68, 72, 74) is  
11 located between at least one pair of adjacent segments  
12 (20a-f).

13  
14 19. A wrench as claimed in Claim 16 or Claim 17,  
15 including resilient bias means (80) associated with  
16 said hinge means (60, 62, 64, 68, 72, 74) and adapted  
17 to bias said ring member towards a closed position.

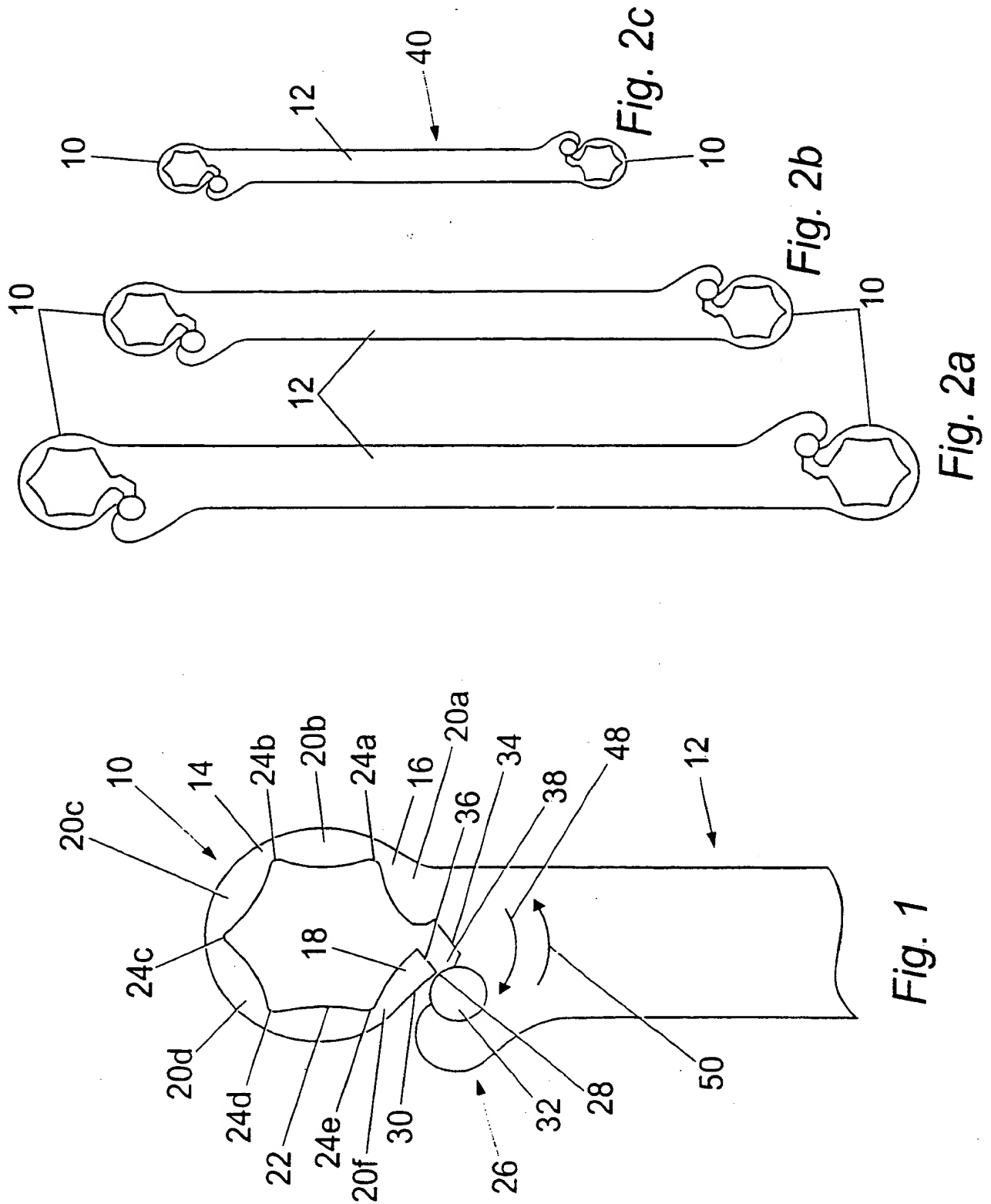
18  
19 20. A wrench as claimed in Claim 1, wherein said ring  
20 portion (114) is pivotably connected to a yoke portion  
21 (204) of said head (110) and comprises a plurality of  
22 segments (120a-f) interconnected by an elongate  
23 flexible member (202) having first and second free ends  
24 (202a,b) secured to said yoke portion (204) such that  
25 pivoting movement of said ring (114) relative to said  
26 yoke (204) in a predetermined direction (148) causes a  
27 length of said elongate flexible member (202) passing  
28 around said ring (114) to be shortened and the ring  
29 (114) to close.

30  
31 21. A wrench as claimed in claim 20, wherein first and  
32 second segments (120a,b) of said ring (114) are formed

1 integrally with one another as part of a pivot member  
2 (200) pivotably mounted in said yoke (204) by means of  
3 a pivot pin (206) and the remainder of said segments  
4 (120c-f) are formed as discrete members, said flexible  
5 elongate member being threaded through said remainder  
6 of said segments (120c-f) and the free ends (202a,b)  
7 thereof passing around an outer surface (214) of said  
8 pivot member and around said pivot pin (206).

9  
10 22. A wrench as claimed in Claim 21, wherein the first  
11 free end (202a) of the flexible elongate member (202)  
12 extends from one of said discrete segments (120f),  
13 passes around one part of said outer surface (214) of  
14 said pivot member (200) opposite an inner surface  
15 thereof defining a first segment (120a), over the top  
16 of, around and under the pivot pin (206), and out of  
17 the front of the yoke portion (204), and wherein the  
18 second free end (202b) of the of the elongate flexible  
19 member (202) extends from another of said discrete  
20 segments (120c), passes around a second part of said  
21 outer surface (214) of the pivot member (200) opposite  
22 an inner surface thereof defining a second segment  
23 (120b), under the first free end (202a) and the pivot  
24 pin (206), and out of the front of the yoke portion  
25 (204).

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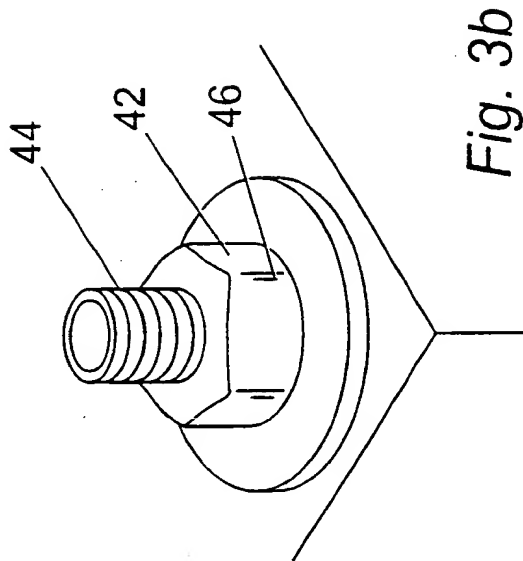


Fig. 3b

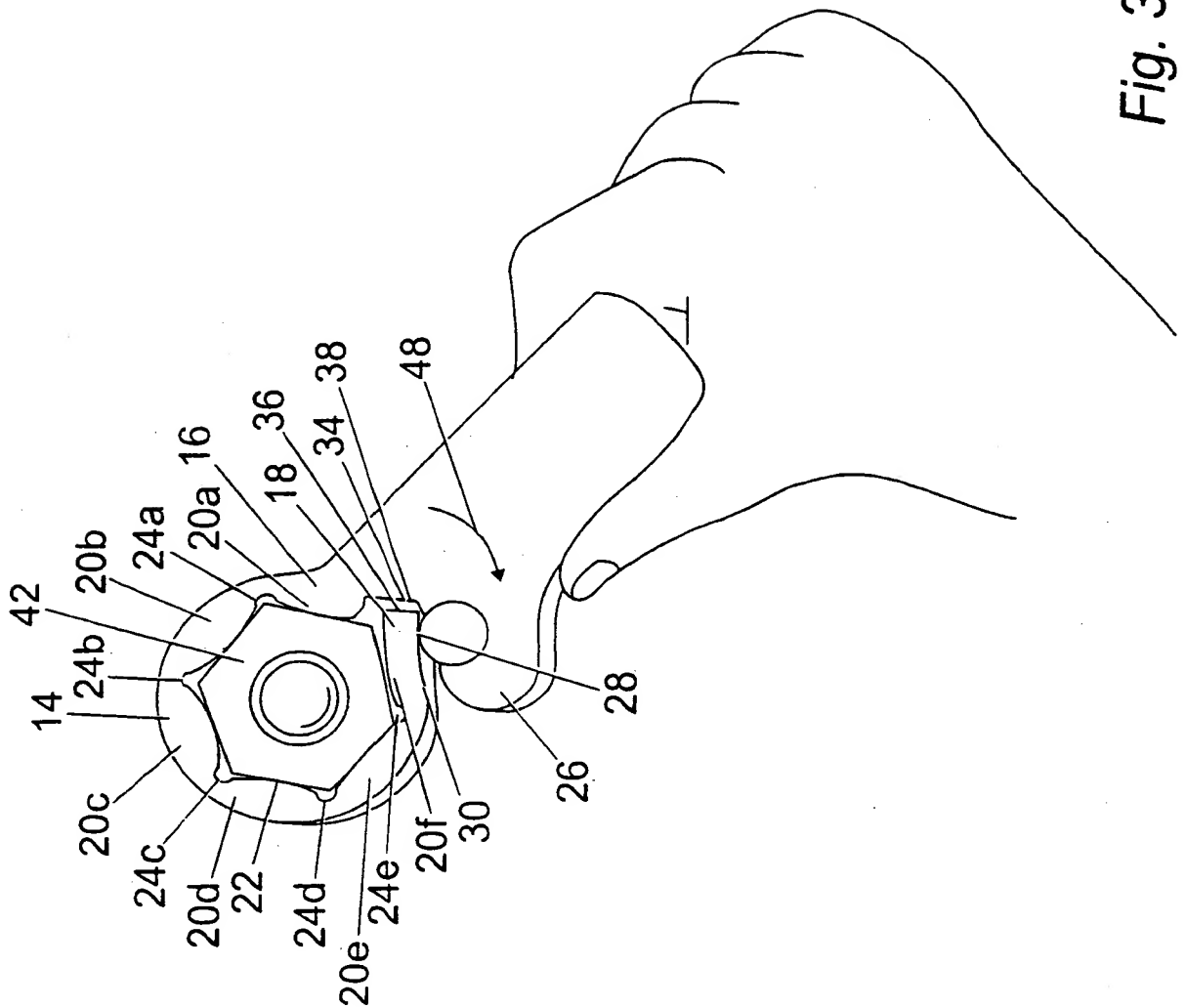
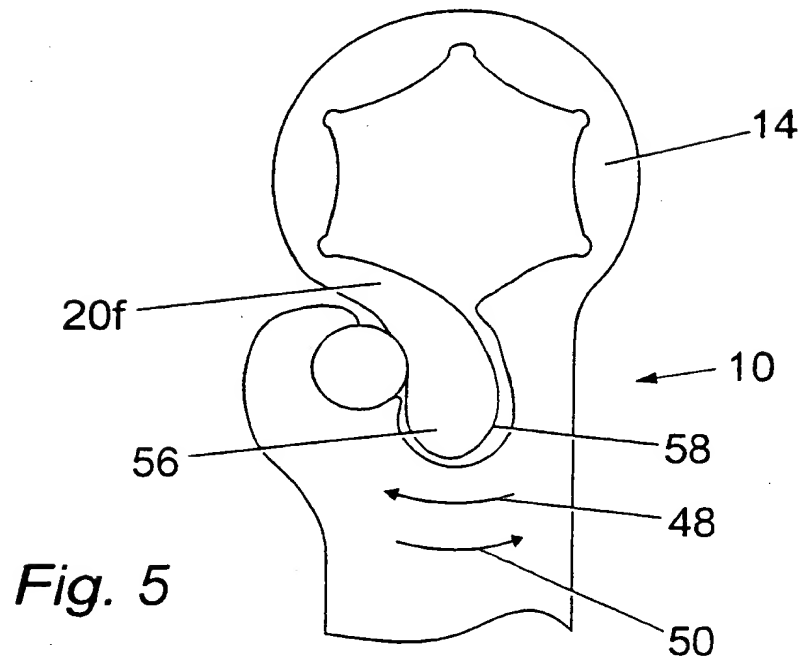
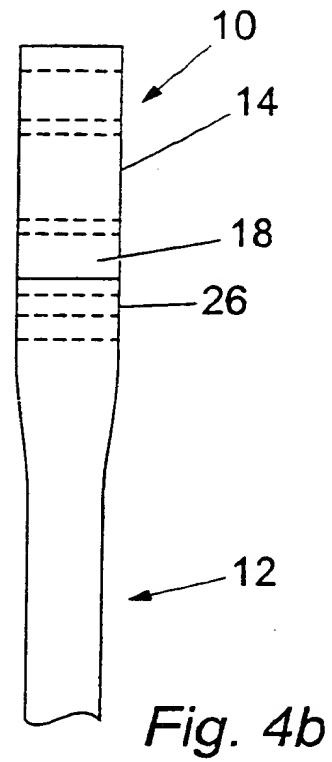
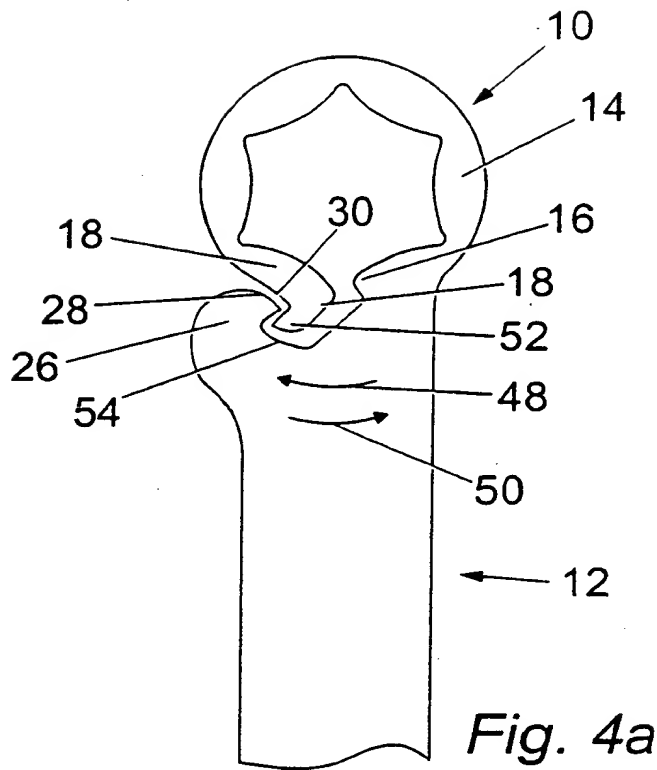


Fig. 3a

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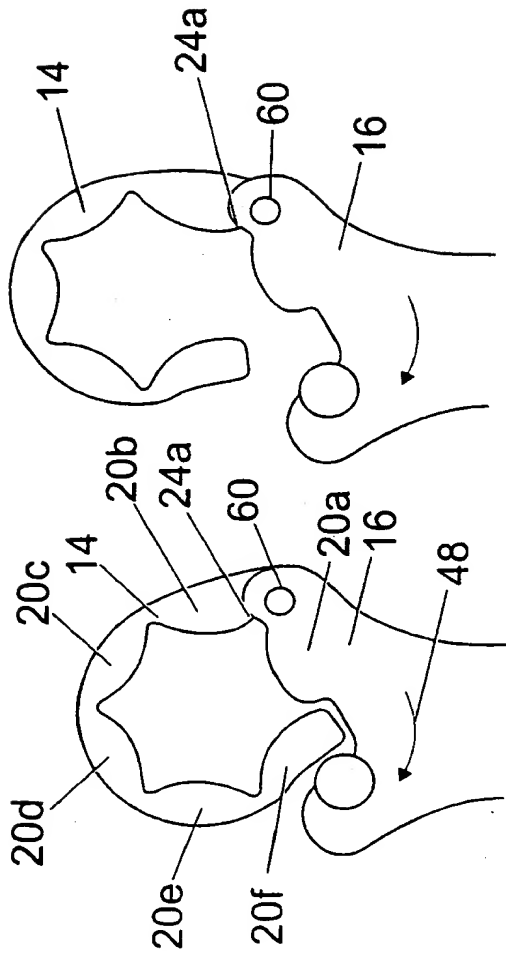


Fig. 6a

Fig. 6b

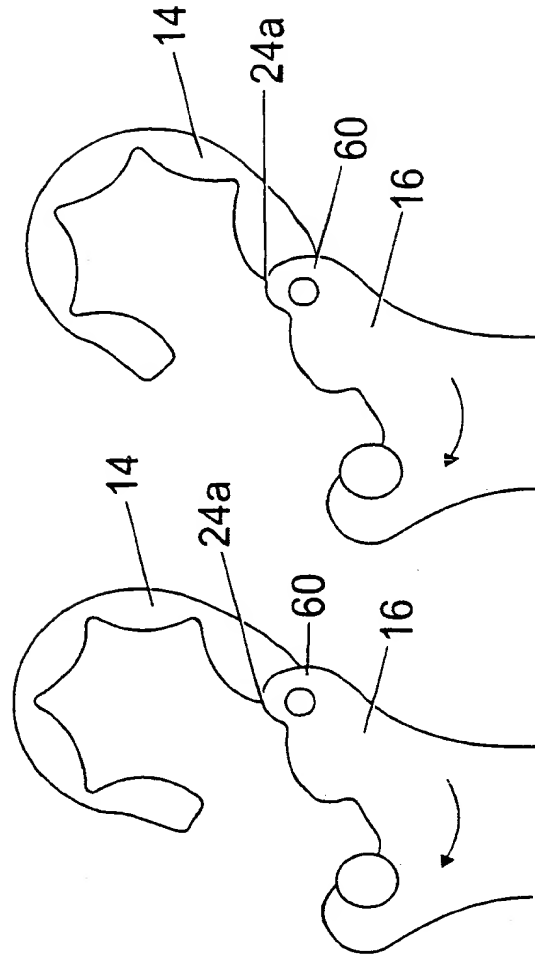


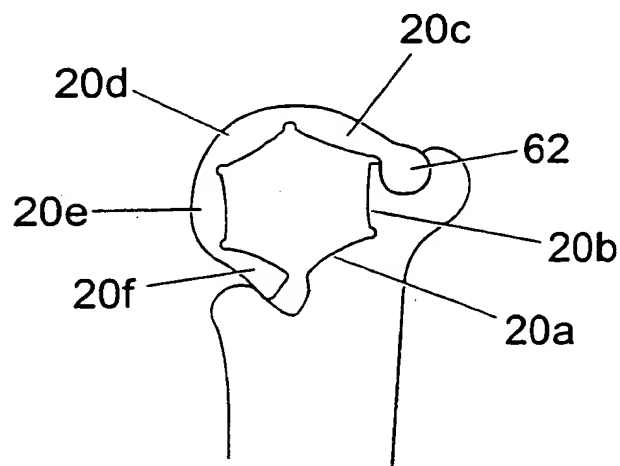
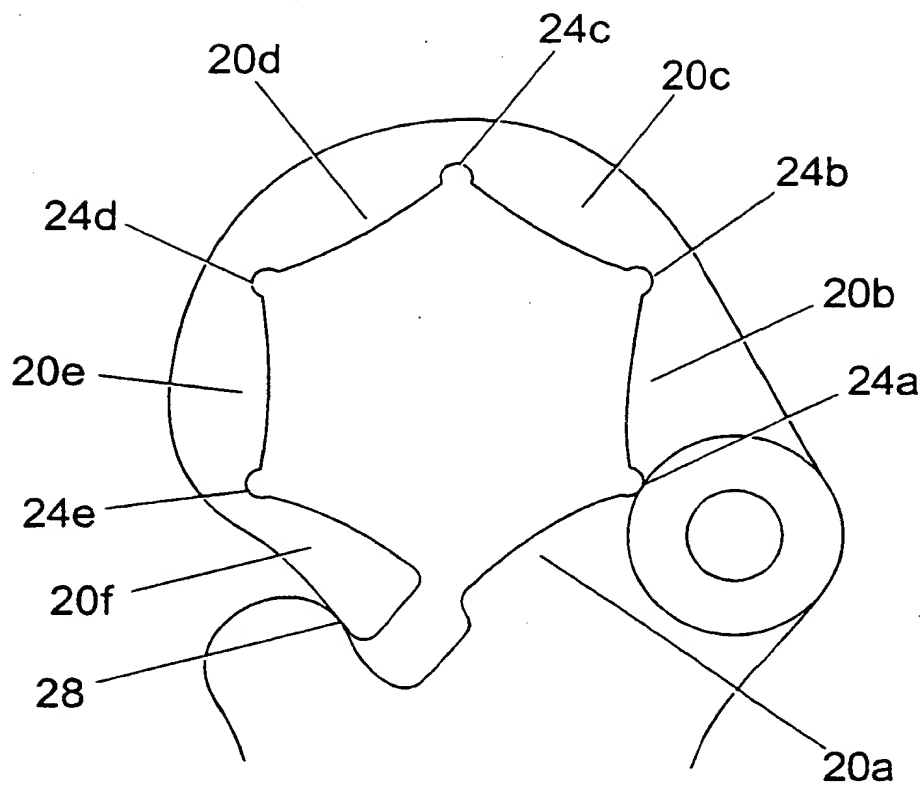
Fig. 6c

Fig. 6d

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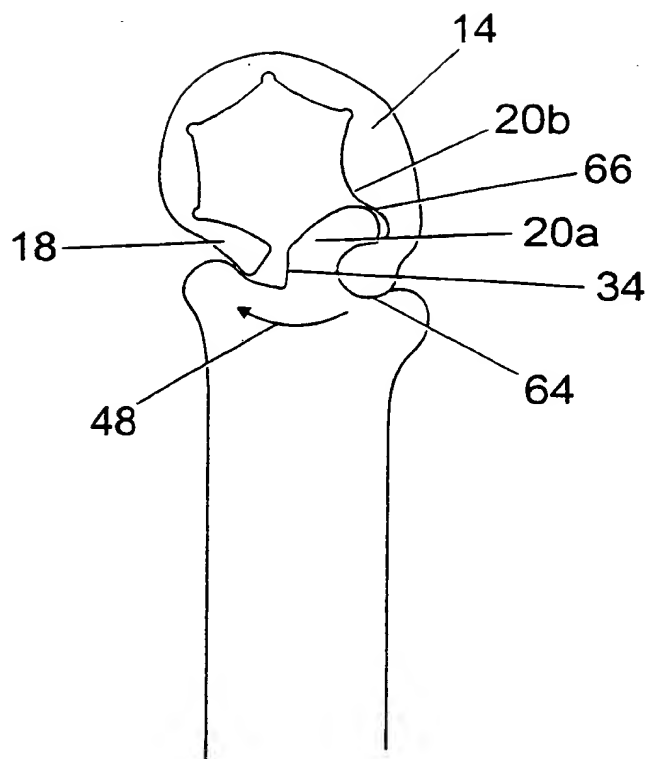
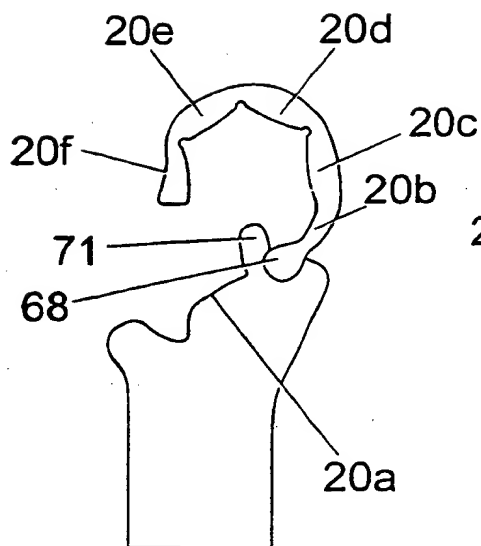
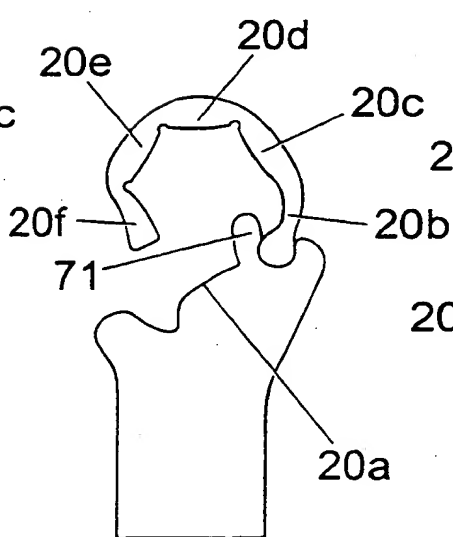
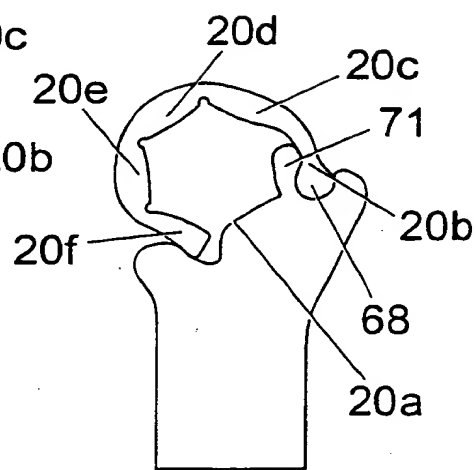
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*Fig. 9**Fig. 10a**Fig. 10b**Fig. 10c*

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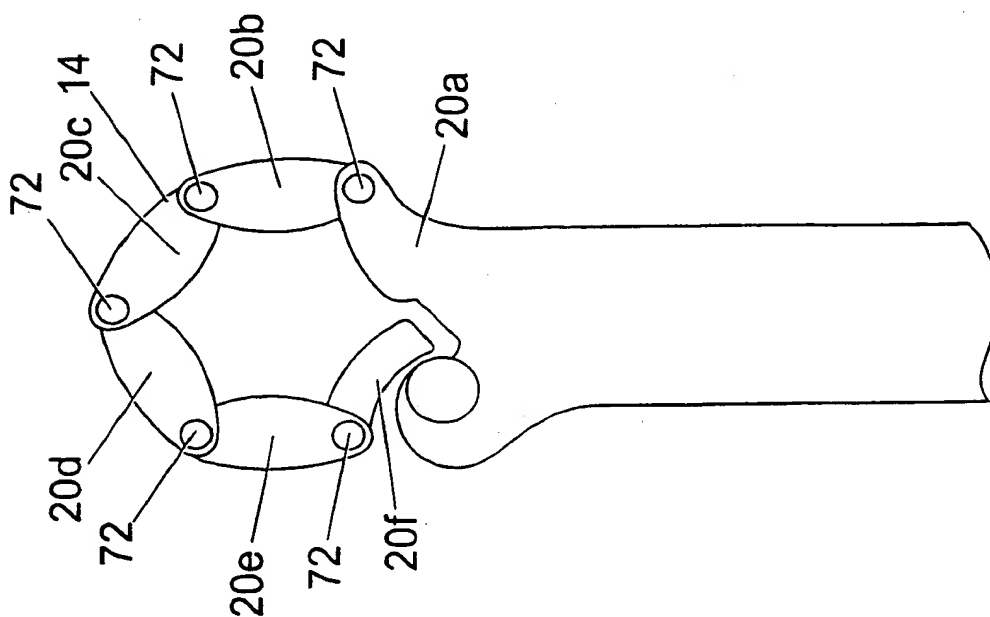


Fig. 11a

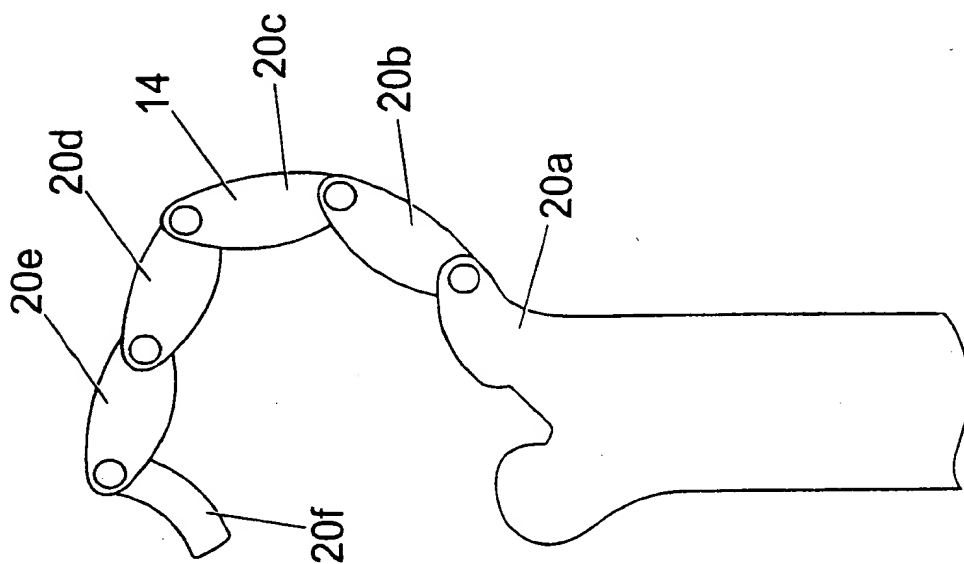


Fig. 11b

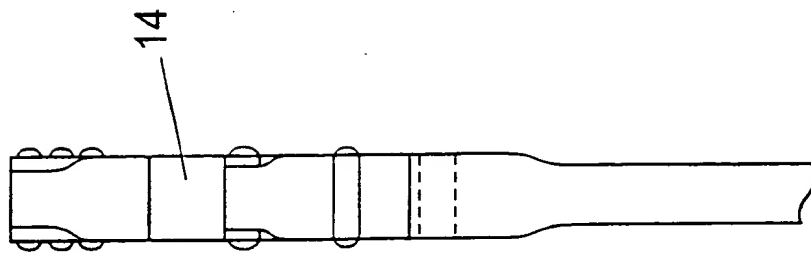
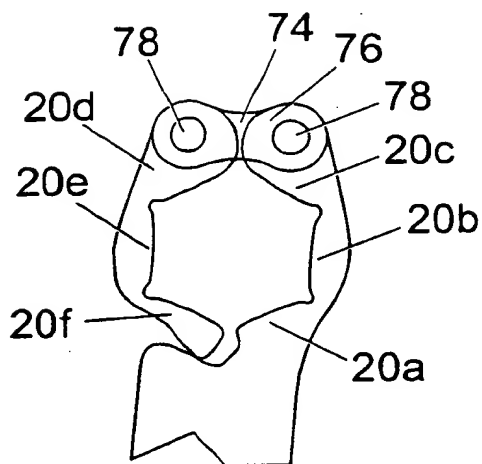


Fig. 11c

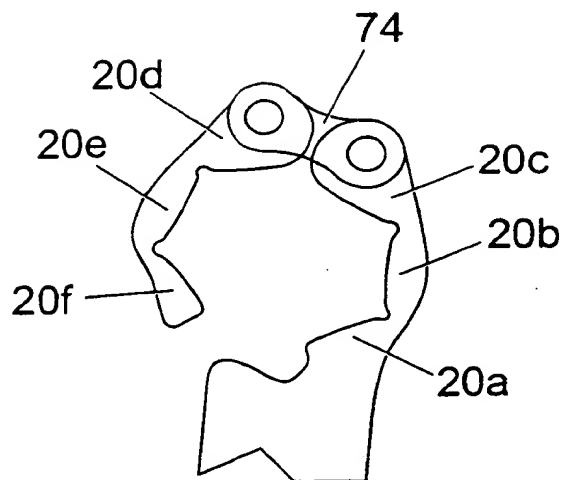
JC05 Rec'd PCT/PTO 0 1 OCT 2001

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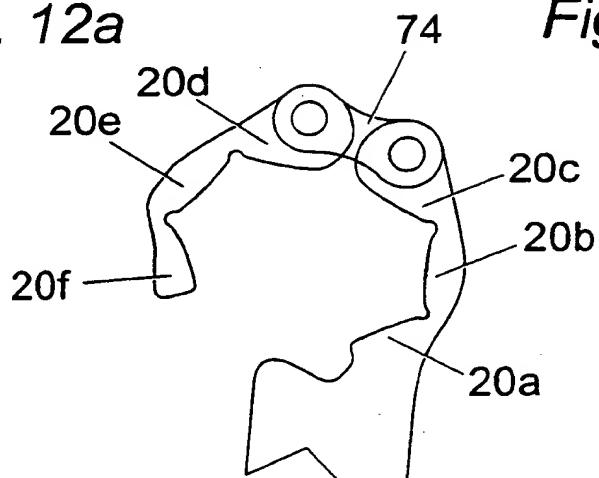
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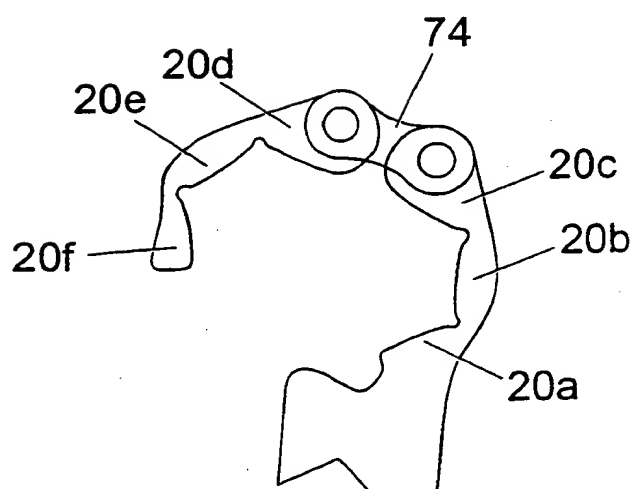
*Fig. 12a*



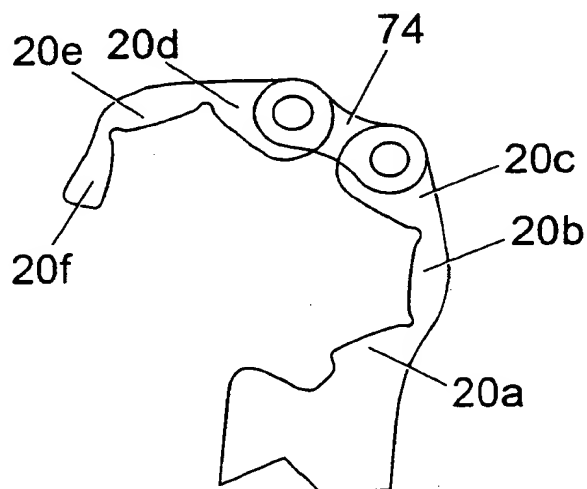
*Fig. 12b*



*Fig. 12c*



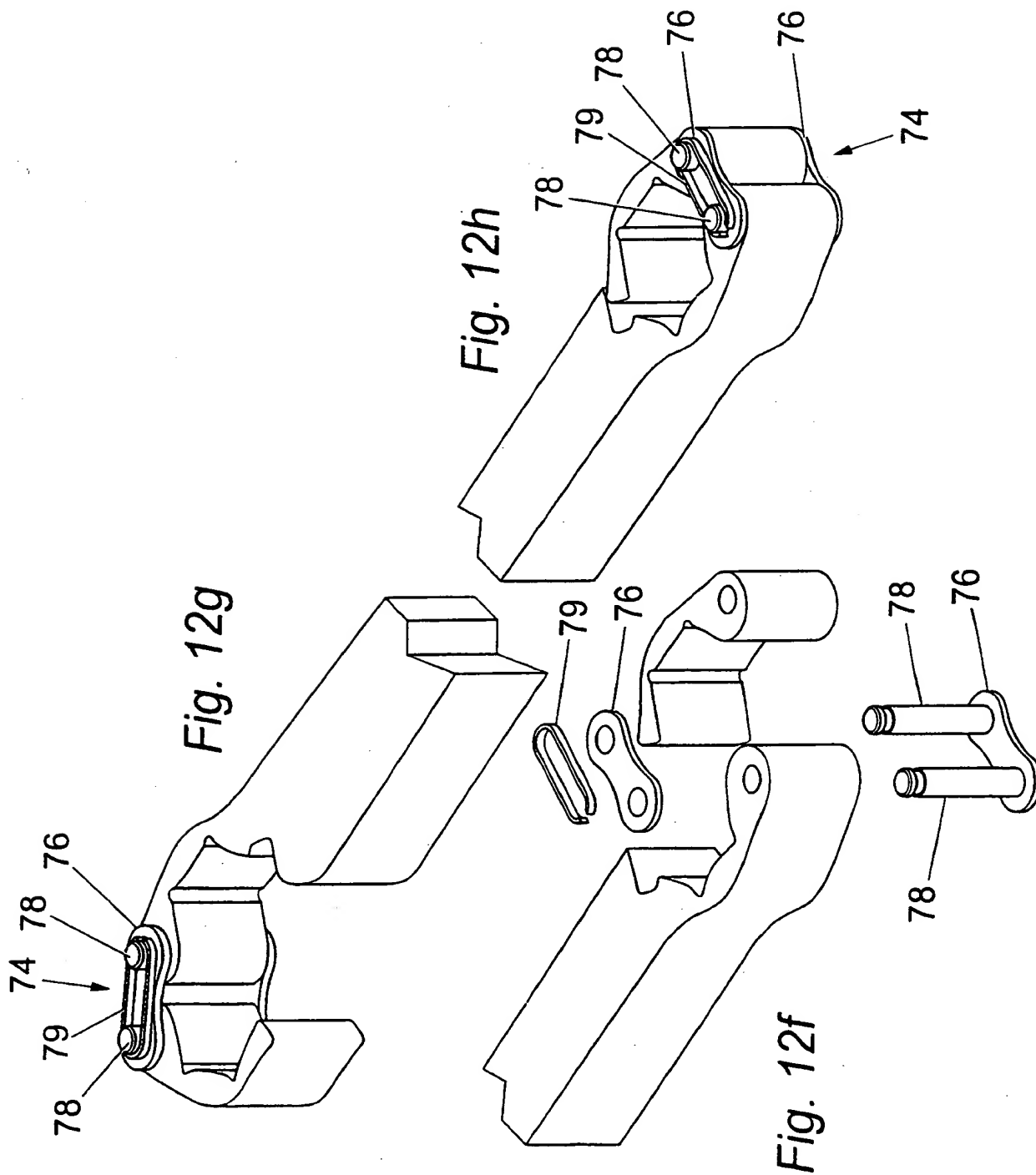
*Fig. 12d*



*Fig. 12e*

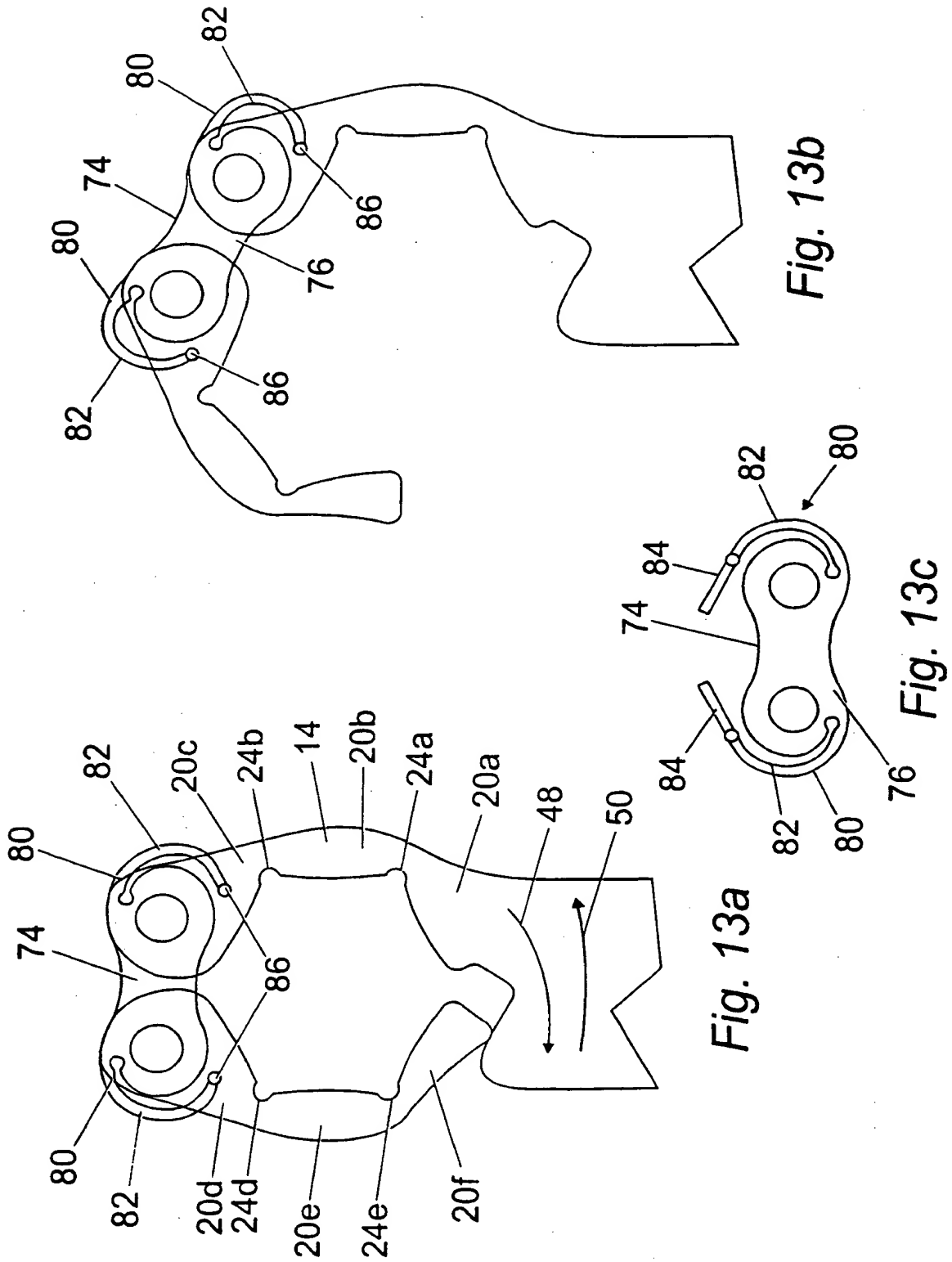
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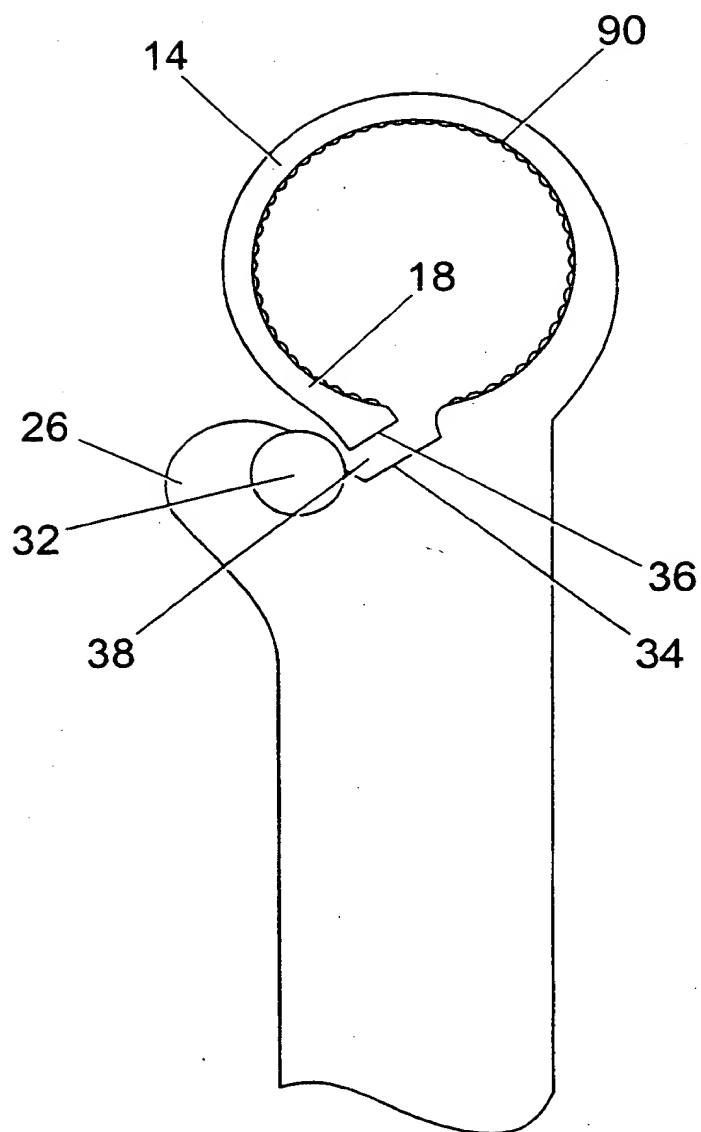
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*Fig. 14*

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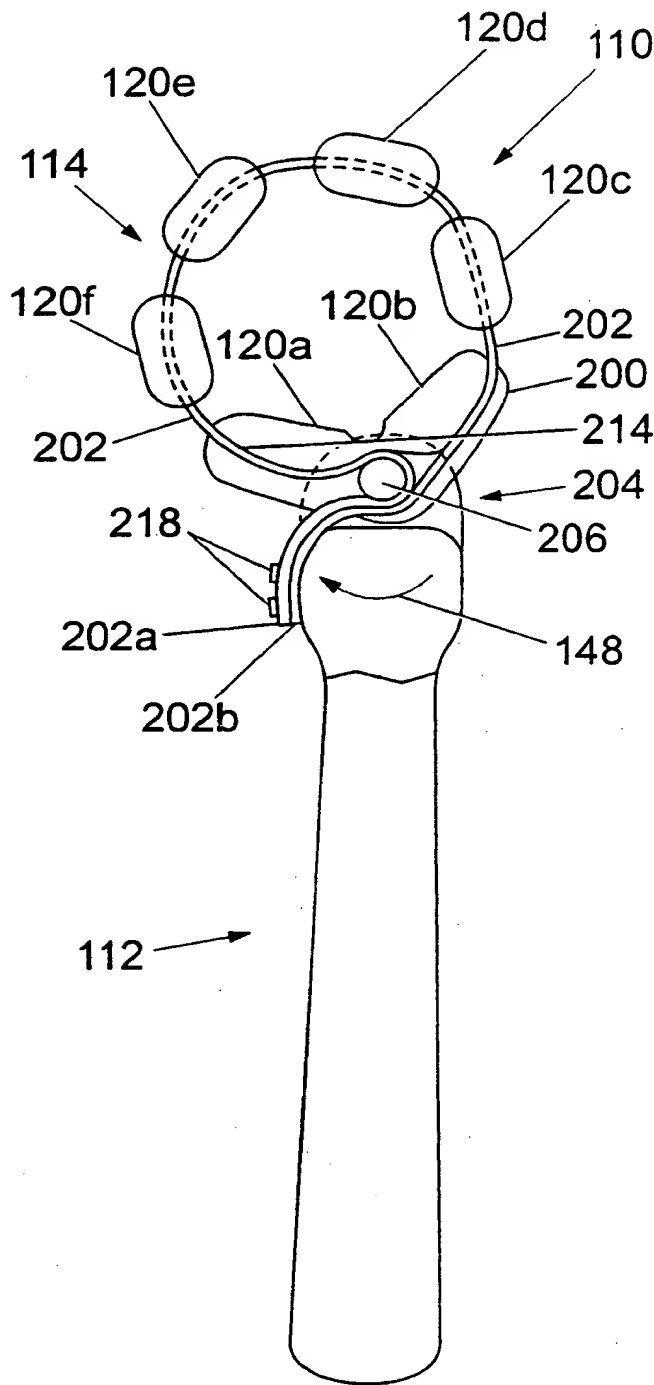


Fig. 15a

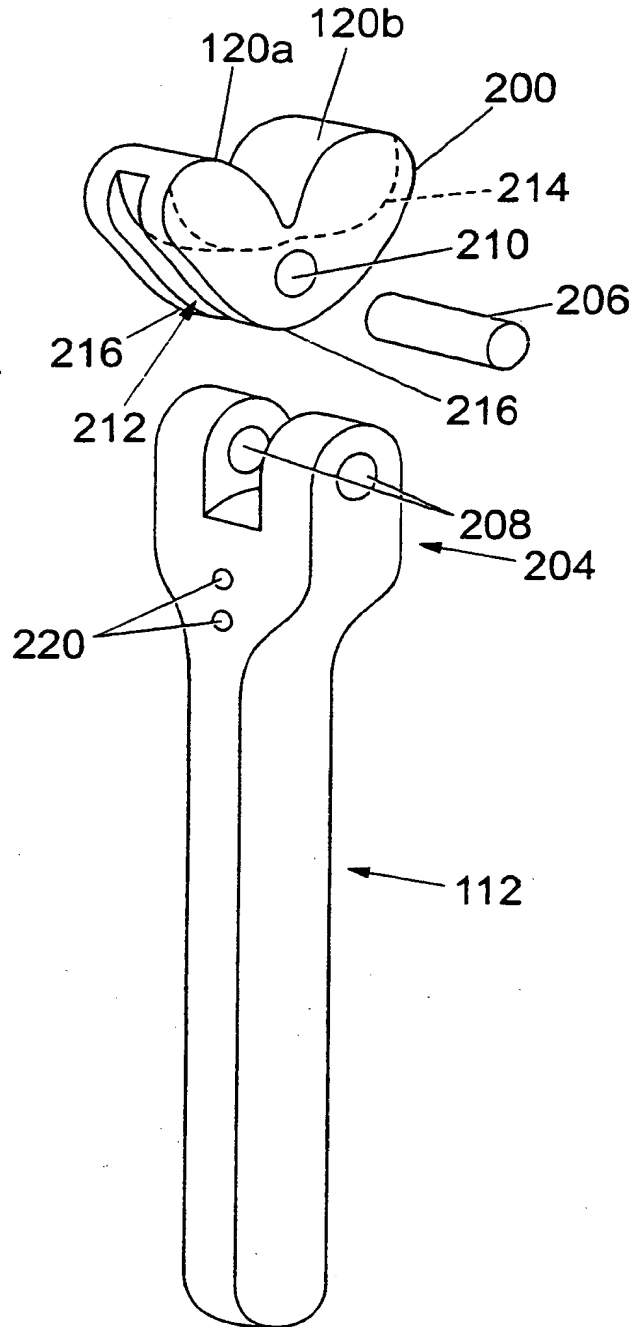


Fig. 15b

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/01204

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B25B13/52 B25B13/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B25B B67B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No.      |
|------------|---|----------------------------|
| X          | US 4 967 612 A (R.SPARLING)<br>6 November 1990 (1990-11-06)<br><br>column 3, line 8 - line 29; claim 1;<br>figures<br>-----   | 1-3,6,8,<br>9,11,12,<br>17 |
| X          | US 2 435 329 A (D.M.STAINPROOK)<br>3 February 1948 (1948-02-03)<br>column 1, line 50 -column 2, line 34;<br>figure 1<br>----- | 1-4,6,8,<br>17,18          |
| X          | DE 16 03 767 A (DAIMLER-BENZ AG)<br>18 February 1971 (1971-02-18)<br>figure 1<br>-----  | 1,2,8-10                   |
| X          | US 1 464 128 A (L.COES)<br>7 August 1923 (1923-08-07)<br>claims; figures<br>-----   | 1,2                        |
|            | -/-   |                            |

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

12 July 2000

Date of mailing of the international search report

20/07/2000

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Majerus, H



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# INTERNATIONAL SEARCH REPORT

International Application No

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages                               | Relevant to claim No. |
|------------|--|-----------------------|
| A          | US 1 666 353 A (A.C.SCHELF)<br>17 April 1928 (1928-04-17)<br>page 1, line 94 -page 2, line 2; figure 1<br>---    | 14, 20, 21            |
| A          | GB 235 434 A (A.I.MANCHO)<br>9 July 1925 (1925-07-09)<br>page 1, line 55 - line 65; figure 1<br>---              | 19                    |
| A          | US 1 610 387 A (J.E.PENNINGTON)<br>14 December 1926 (1926-12-14)<br>page 1, line 73 - line 77; figure 1<br>----- | 14, 20                |

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/01204

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|---|---------------------|----------------------------|---------------------|
| US 4967612                                | A                   | 06-11-1990                 | NONE                |
| US 2435329                                | A                   | 03-02-1948                 | NONE                |
| DE 1603767                                | A                   | 18-02-1971                 | NONE                |
| US 1464128                                | A                   | 07-08-1923                 | NONE                |
| US 1666353                                | A                   | 17-04-1928                 | NONE                |
| GB 235434                                 | A                   |                            | NONE                |
| US 1610387                                | A                   | 14-12-1926                 | NONE                |

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